The Builder.

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Roads.

ROADS constitute an important element in the development of every new country, and although means of communication have been vastly increased during the last fifty years by the extensions of the railway system, ordinary highways remain as absolute essentials to the welfare and prosperity of countries which have been settled for centuries past. Taking the case of Great Britain, we have only to consider the conditions prevailing in great cities to realise the magnitude of road traffic and to recognise the advantages of good roads, and the disadvantages of bad ones. In many country districts roads still form almost the only means of communication from place to place, whether for pleasure or for business. No doubt the supercession of stage coaches, carriers' wagons, and other conveyances has exercised a very prejudicial effect upon the prosperity of country towns, villages, and wayside inns; but the advent of cycling has done much to restore the balance, and automobilism is destined to contribute very largely to the future traffic of provincial highways. The work of the engineer who makes and maintains roads has lost none of its importance, and we are glad to notice the publication of an excellent treatise on the subject* by Mr. Thomas Aitken, Surveyor to the County Council of Fife, Cupar Division, who is recognised, especially in Scotland, as one entitled to speak with authority. About the making of ordinary roads, it may be thought, there is not much new to be said, but it must be remembered that many treatises on the subject were written at a time when machinery had been very little applied to the quarrying and preparation of the materials, and to the actual construction or repair of roadways. It has also to be borne in mind that the extended powers conferred on the County Councils by the Local Government Acts of 1888 and 1889 have resulted in the inauguration of measures for maintenance upon a much more comprehensive scale than had previously been practised. Road surveyors of the present day are therefore expected to be familiar with the most approved forms of mechanical appliances and with the latest methods of procedure. In urban districts surveyors are required to add a knowledge of the surface construction most suitable for crowded streets, and to be competent to deal with many special problems that do not arise in rural districts. It is evident, therefore, that the present time is most opportune for the publication of a comprehensive work dealing with the various features of modern road-making, and the treatise written and compiled by Mr. Aitken constitutes an eminently painstaking and lucid exposition of the whole subject, which will be of great practical value to municipal and county engineers, and to those who wish to qualify themselves for such positions.

The treatise is nominally divided into two parts, the first relating to "the making and the maintaining of macadamised roads," while the second part deals with "carriageways and footpaths." Outside the first part, however, there is a historical sketch containing much that is intimately related to the chapters following; and at the end of the second part a chapter is usefully devoted to a recapitulation of the teaching generally conveyed in the whole treatise.

In the first page of his historical sketch the author remarks: "The evolution of the modern road can only be adequately understood by reference to the practice of this interesting subject, from the time when the making of the great military roads of the Romans was carried out to the present time, authentic descriptions of which are recorded. It will be necessary, therefore, previous to detailing the different processes from the inception to the completion of roads and streets as now constructed, to review concisely the history of the subject, which extends over a period of 2,200 years." It is generally said—and the remark is repeated by Mr. Aitken—that "there is no trace of Roman influence in the construction of later roads in Britain." This is no doubt true as regards general design, but we rather incline towards the belief that the thoroughly sound and workmanlike methods adopted by the Romans have not been without some useful effect. For instance, Roman engineers were careful to remove loose earth and to replace it where necessary by proper material, consolidated by ramming until a solid foundation was formed, and upon this two or three courses of flat stones were laid by hand. Again, in marshy places, joists or sleepers were laid, over which came a stratum of straw, and then the road materials, generally including a layer of coarse concrete. These forms of construction are clearly suggestive of the principles followed by Telford and others, though the exact mode of application may have been different. Having referred to early British roads, the author proceeds to relate some details concerning the execrable condition of highways during the Dark Ages and up to the advent of Metcalf, Macadam, and Telford. The rival systems of the two latter engineers are described at length, and Telford's general specification for the Highland roads is given in detail. The work in question included some 920 miles of roadways, in connexion with which no less than 1,117 bridges and other works of considerable magnitude were necessitated by the hilly nature of the country traversed. The specification is still interesting, relating as it does to the largest series of contracts for road-making ever undertaken in this country.

Chapter I. is devoted to the discussion of resistance to traction, the forms and dimensions of wheels, and the permissible weights to be carried on wheels. All the points here considered are important to the road engineer, though unfortunately many of them are beyond his immediate control. Under the heading of external forces affecting the

* "Road-making and Maintenance: a Practical Treatise for Engineers, Surveyors, and others." By Thomas Aitken, A.M.Inst.C.E. London: Charles Griffin & Co. 1900.

motion of vehicles, the author remarks upon the injury done to a road surface by a vehicle surmounting any hard substance, tending by repeated blows to wear holes in the surface, even on roads maintained with the hardest material. This caution might well be taken to heart by some of our Local Authorities, even in the metropolis, who appear to be entirely oblivious of the discomfort experienced by passengers, and of the fact that neglect of proper maintenance is not a real economy. On the subject of tractive force, Mr. Aitken presents an excellent *résumé* of the conclusions arrived at by various authorities, including Morin, Macneil, and others; he also demonstrates very clearly the effects produced on a road by wheels of different widths. It is pointed out that the old-fashioned conical wheels "can only be made to travel in a straight line by a constant twisting action at the surface of the road;" consequently, the wider the tire, the greater is the disintegrating action of the wheel. Ordinary rigid wheels of excessive width are shown to exercise an equally injurious effect, because they cannot possibly touch the convex transverse surface of a road along their full width. Mr. Aitken is of opinion that the wide wheels of waggons and traction engines are powerful agents in destroying the crust of a road, for the reason that excessive bearing pressure is caused by the parts which are in actual contact. As he points out, traction-engine wheels with ordinary rigid tires cannot bear equally on a road unless it be in such a state of disrepair as to be level transversely, "when it cannot be expected to bear even the distributed weight which such conditions make possible." Mr. Aitken continues:—

"In the case of a traction-engine, the wheels of which only touch the road surface for 4½ in. of their width, a very heavy strain is imposed on the material composing the road covering. During dry weather this excessive weight causes a considerable amount of abrasion of the material at the surface of the road. When thaw succeeds frost, and the immediate surface of the road coating is in a somewhat loose state, the passage of traction-engines has the effect of greatly disturbing the materials of the road-crust on roads generally, and is extremely trying even to those which are repaired with the best possible class of macadam, and maintained in the best condition. It often happens, after alternating frost and thaw, that the road coating is affected to a greater or less depth; and at such times the passage of a traction engine over a road causes considerable damage by crushing the stones comprising the coating, and in many instances lifting and displacing patches of the material."

Vehicles with very narrow tires are found to cause much damage under similar conditions, especially where there is little passing traffic to prevent such wheels from forming ruts. The author, therefore, emphasises the necessity of having improved tires for vehicles, or of adopting more stringent measures for the regulation of traffic.

In regard to the laying out of roads, although a work of this kind cannot be expected to include a treatise on surveying, it would have been as well if some notes had been given upon the most approved types of instruments, especially those which are necessary to engineers in India and the colonies. An addition of this kind would probably be welcomed by students who are qualifying for service abroad, and it would at the same time be in harmony with the complete manner in which most other sections of the subject have been discussed and illustrated. In his chapter on earthworks, drainage, retaining walls, culverts, and bridges, the author has not attempted more than a brief enunciation of those points which most directly concern the road-maker. What he has said is a model of concise expression; it is particularly to the point, and is illustrated by a number of sectional and other drawings which cannot fail to be of service to practical men.

The chapter on road materials or metal is not bad, but the author is not quite at home in this part of his subject. In so far as the actual description of the rocks is concerned, the information is for the most part derived from the article "Geology," in the "Encyclopædia Britannica," and may certainly be relied upon. But some of the author's original observations are not quite up to the mark. For instance, we notice that "the igneous and siliceous rocks form the greater bulk of the materials used in road making and repairs." It should have been remembered that many of the igneous rocks used are of a highly siliceous character, though what the author had in view in employing the term "siliceous" was, no doubt, sandstone and the like. The importance of a knowledge of the minerals found in road materials is rightly insisted upon, and the value of geology to the road surveyor is also clearly brought out. The section relating to physical tests of road stone is also well considered, and the author is, in general, up to date. The observations on the absorption test are not, however, everything that could be desired. It is stated that the test "is carried out by weighing the stone carefully after being thoroughly dried, and immersing the sample in water for twenty-four hours." We admit that this is the slip-shod method commonly employed; but if this test means anything, it must be for the purpose of comparison. For the comparison to be of real value, all the samples of stone tested ought to be cut to the same size, and instead of immersing them entirely in water, a flat surface of the sample should always stand up above the surface of the water for about a quarter of an inch. A little table, showing how much water is absorbed by granite, gneiss, &c, is given, but all such generalities are useless unless the locality whence the stone came in each case is mentioned, or, at least, the stones which gave the maximum and minimum absorption, from which the table was compiled. This table is taken from Rankine's "Civil Engineering," however. The author evidently knows very little about the "weathering test," for we have the old method of using Glauber's salt (sulphate of soda) mentioned, though everybody familiar with the subject is aware that that method is of no practical use, and has been discarded in nearly every testing establishment on the Continent for many years. Again, we are told that freezing tests on the weathering of stone can "only be effected during the prevalence of frost, and are consequently not always easy of application"; whereas, as a matter of fact, the experimenter does not, commonly, wait for the weather, but employs artificial means of freezing. The notes on the durability of road stone are excellent, and we quite agree that the average basalt, diorite, and syenite are amongst the most durable materials that can be employed on roads. One point in this connexion is a little striking. The author employs many rock names which one never sees in surveyors' tenders for road metal, and which not one surveyor in 100 understands. These terms (which are explained) are not by any means new, but that they should be employed in a practical book of this kind is very gratifying, as indicating a greater appreciation of a scientific knowledge of road stones than has hitherto been shown by practical men. We have on many occasions insisted that unless the surveyor is able to distinguish the difference between stones that are apparently the same at a casual glance, he does not always get the best result when advertising for tenders. Occasionally, however, the author makes a slip even on this point. On p. 110 we notice that he calls the Mountsorrel stone "syenite," the Bardon Hill (erroneously stated to be in the North of England) "basalt," and the Ceirog *(sic)* stone "granite." But, whilst we indicate these little inaccuracies, we must add that we do not know of any other work which deals better with the subject, and this chapter is certain to be of some general use to the surveyor.

It would be impossible to refer at length to the chapter on quarrying, which covers more than sixty-five pages, and constitutes a fairly complete exposition of the subject. Two types of rock drills are selected for special description, their construction and mode of action being illustrated by sectional drawings. With the remarks as to the superiority of drills with steam-thrown valves over those with tappet-valves we agree in the main, although under some circumstances a tappet drill may be preferable. Intending purchasers will always act wisely in furnishing full particulars of requirements to the maker selected, so that tools may be obtained exactly suited to the character of the work to be performed. Several useful plans and sections of road-stone quarries are given, together with practical hints as to boring shot-holes, the use of explosives, and drawings of a storehouse for explosives. As an instance of the advantageous results to be obtained from the employment of machinery, the author states that a quantity of from 1,000 to 1,400 tons of stone can be quarried in one week, whereas in order to produce by hand a like quantity of quarried material the employment of twenty-four men would be required each day for a similar period, or a boring squad of three men would be engaged forty days in performing a like amount of work. Mr. Aitken demonstrates that "there is a saving of nearly 49 per cent., and when the hand-quarried material is stored, of over 59 per cent." by the adoption of mechanical quarrying and blasting.

A good many points of interest to the surveyor who may be called upon to select and to superintend the use of a steam-roller will also be found in the book. As illustrating the extent to which this method of road-rolling is now practised, it is stated that "the firm of Aveling & Porter alone have made and sold over 3,000 steam road-rollers, the majority weighing from 10 to 15 tons." In London, more than 100 rollers are in daily use on an area of 400,000,000 square yards, representing about 2,000 miles of roadway 30 ft. wide. Although scarifying machines have only lately come into extensive operation, and in fact have not been produced in a practical form until within comparatively

recent years, the idea was patented by Clay in the early part of the century. His apparatus, as Mr. Aitken records, was designated "a harrow which is intended to scarify the uneven part of any road." The author might also have mentioned the steam-driven "Teaser" invented at an even earlier date by Trevithick. One of the benefits to be obtained by the use of a scarifying machine is that roads which have become of bad form, are otherwise but very little worn, may be broken up and re-formed at comparatively trifling cost, and in many instances without the addition of new metalling.

When all the technical problems attending the design of a road have been happily settled, the actual work of construction requires no abstruse knowledge, and the whole process is described by Mr. Aitken in less than two pages of letterpress. Briefly described, the making of a modern road is as follows:—The bed is first prepared, and the "bottoming" material, consisting of a layer of stones, varying in size from 3 in. to 4 in. cubes, is spread to a depth of from 6 to 12 in., according to circumstances; over the bottoming comes a cushion of sand from 1½ to 2 in. thick, and, finally, the metalling is laid to a depth of from 4 to 6 in. Two sectional drawings in this chapter, one of a country road and the other of a suburban road, will be found useful, as also will the author's hints as to the work of construction.

With Chapter IX. commences the second part of the treatise, which is specially addressed to the requirements of municipal engineers or borough surveyors. The reader will find, however, that he must refer to Part I. for some of the information necessary for complete elucidation of the subject of carriage-ways and footpaths. In the course of some preliminary remarks, the author states the essential features which should be possessed by a good pavement for carriage-ways, adding the caution that the physical, climatic, and other features of cities and towns must always receive attention when a selection is under consideration. A roadway paved with granite or other "setts," properly laid upon a good concrete foundation, is undoubtedly durable and economical. It affords a good foothold for horses, and may be cleansed with comparatively little trouble; but, on the other hand, it is very apt to become greasy under certain conditions, and is then particularly trying to horses. Perhaps the greatest objection to the use of such pavement is the excessive noise produced by wheeled traffic.

Pitched pavements are a great deal used in manufacturing towns, for which they are not entirely unsuitable, but some less noisy form of paving is essential for residential and mercantile districts. Those of our readers who are acquainted with the north of England know that "setts" are very extensively adopted, even in the outlying suburbs of large cities and towns, and their use is still common in the south. The operation of wood paving is tolerably familiar to Londoners, many of whom have reason to regret the frequent opportunities afforded for its study. Most of the earlier attempts to construct satisfactory pavements of this class resulted in failure, owing to the selection of unsuitable material and to the absence of proper foundations. The statistics quoted by Mr. Aitken as to the relative wear and tear of soft and hard wood blocks will be found highly interesting. Generally, the conclusion is to be drawn that the average life of soft wood pavement in the busiest thoroughfares of London is about 6½ years, and that Australian hard woods may be expected to last at least ten years. The cost of paving, assuming the existing foundations to be sufficient, is 8s. for deal and 11s. for Australian hard woods per square yard. As is well known, asphalt forms an impervious roadway; it affords no opportunity for the collection of foreign matters, and as the road retains its convexity, the surface drainage is always effective. From a hygienic point of view asphalt is preferable to wood, but those interested in vehicular traffic do not appreciate its slipperiness in damp weather. The table following, reproduced from the volume under review, is contained in a report by Mr. Haywood on accidents to horses on carriage-ways in the City of London.

City of London: Comparative Slipperiness of Carriage-way Pavements.

Pavement.	Distance Travelled before a Horse Fell—in Miles.			
	Dry.	Damp.	Wet.	Average of 30 days.
Granite	78	168	537	132
Asphalt (Val de Travers)	223	125	192	191
Wood (Improved Wood and Ligno Mineral)	646	193	432	330

The remarks upon this table by Mr. Haywood are particularly interesting, and so also is a table comparing different classes of pavements, reprinted from "Carriage-ways and Footpaths," by Mr. H. Percy Boulnois.

The recapitulation chapter includes a description of the Viagraph, the instrument lately devised for taking an autographic record of road and carriage-way surfaces. The viagraph is described as being "in principle a straight-edge about 12 ft. long and 9 in. wide, applied continuously to the road surface, along which it is drawn. The main frame contains an apparatus for recording on paper a profile of the road surface tested, and the sum of unevenness is indicated by a numerical index." Reliable data can only be obtained by the aid of the viagraph when the instrument is used in an intelligent manner. Thus it is necessary that several diagrams should be traced along parallel courses on any given roadway, so that a fair average may be obtained. As the viagraph records facts and not opinions, it ought to be the means of reducing litigation to a very considerable degree, and also of enabling road surveyors to protect themselves against complaints based on erroneous impressions. Some interesting viagraph diagrams are given by the author, including one taken on the Victoria Embankment, which is probably one of the worst-kept roads in existence. As compared with the Leatherhead and Guildford-road, showing an unevenness of from 12 ft. to 14 ft. per mile, the Embankment "viagram"—if we may coin the term—indicates an irregularity of no less than 102 ft. in the same length. Repairs are now in progress on this splendidly situated thoroughfare, and it may be hoped that similar operations will some day be contemplated in regard to others, notably the road separating Hyde Park from Kensington Gardens, and one or two of the roadways in the park itself. In the first page of Mr. Aitken's admirable work we find it stated that the good condition in which roads are maintained affords "a fair indication of the progress or prosperity of any age or people." This sentiment might well be taken to heart by the authorities responsible for the habitual neglect of the thoroughfares mentioned, and it deserves to be kept constantly in view by surveyors in every part of the kingdom.

NOTES.

St. Martin-in-the-Fields.

IT is satisfactory to find that the London County Council have determined not to be a party to meddling with the steps of the portico of St. Martin-in-the-Fields, and we hope it will now be recognised that the attempt to spoil Gibbs's church might as well be abandoned. It is also satisfactory to learn that this course was adopted in consequence of the Report of the Institute of Architects on the subject. It has been too much the custom of the London County Council to go through the form of asking the opinion of the Institute on architectural points and then refusing to pay any attention to it. We hope a new precedent may have been set by this case.

Discoveries at Bosco Reale.

BOSCO REALE, near Pompeii, which some years back enriched the Louvre with a magnificent set of silver caps, is now the scene of new discoveries of equal importance. In a vineyard not far from the place, a building containing twenty-four rooms, presumably a country house, has come to light. The remarkable thing is that in all these rooms not a single object of any description has been discovered, but each and all are decorated with beautiful frescoes, which for freshness of colour and generally fine preservation are equal to anything discovered at Pompeii. It really looks as if the house had been built on speculation and remained "unlet." Of the seventy frescoes, most represent flowers and fruit, but there are three notable figure pieces. One represents a lute player, double life-size, whereas at Pompeii no fresco figure exceeds natural stature. Another represents an old gladiator performing to a woman; the third, a woman in the attitude of a listener. The house presumably belonged to the last days of the Roman Republic. All the frescoes have been carefully detached, and are stored at Bosco Reale.

The Corporation of London.

DURING the next session of Parliament the Corporation will promote Bills for the following purposes:—They propose to remove the present London (City) Freemen's Orphan School to new buildings to be erected upon a site of 14½ acres at Walton-on-the-Hill, near Reigate, of which they have lately become the owners. The school was established at Brixton in pursuance of an Act passed in 13 and 14 of the current reign. They intend to purchase or acquire, by compulsion or agreement, the Spitalfields Market with the object of carrying on and improving the market traffic, and with powers to sell subsequently or lease the undertaking

to the Council of the Borough of Stepney; and have prepared a Bill which shall confirm and give effect to the agreement, dated in July last, between them and the London Riverside Fish Market Company for the purchase by the Corporation of the fish market at Shadwell, and in virtue of their charter of 1 Edward III. for continuing the traffic there in various commodities, in addition to the sale of fish authorised under the initial Act of 1882. Two other Bills relate to grants by the Corporation as Governors of building and improving leases in respect of the Bridewell and (old) Bethlehem Hospitals property, with exemption from the control and jurisdiction of the Charity Commissioners; and by another Bill they seek for powers to dispose of the site of Christ's Hospital, which they, on the other hand, as Governors of St. Bartholomew's Hospital, desire to purchase.

The National Gallery and Trafalgar-square.

THE recent fire in some premises adjoining the National Gallery is not without good results in one direction. The Commissioners of Works and Public Buildings will apply next Session for an Act authorising the Government to acquire some property, upon the west side of the Gallery, which is now bounded on the west by No. 11, Pall Mall East, with Nos. 5 and 9, Monmouth-court; on the south by Pall Mall East, and on the north by some stables belonging to, and occupied by, the Earl of Lonsdale, We hear that the London County Council propose to carry out some improvements of the fountains and the open space in Trafalgar-square. The fountains and their basins, executed in Peterhead granite by McDonald & Leslie, of Aberdeen, were, together with the angle lamp standards, designed by Sir Charles Barry, R.A., who also prepared the plans for laying out the square, which was (*vide* the *Gentleman's Magazine*, 1837) begun on August 14, 1837, with the laying of the broad foot pavement in front of the National Gallery. The area had been cleared by the removal of the Royal Mews, the (old) Golden Cross Inn, and some courts and alleys, including the Bermudas, at the lower end of St. Martin's-lane. The National Gallery was begun in 1832, and W. Wilkins's part of the design was completed in 1838, the Corinthian columns (but not the entablature) of the portico being from Carlton House, and much of the stone from the King's Mews. The College of Physicians and the Union Clubhouse were designed by Sir Robert Smirke, 1822-5; to the latter Decimus Burton made some alterations and additions. The buildings on the east side of the square, comprising "Morley's" Hotel, were designed and built upon his own property by George Ledwall Taylor, who died at a very advanced age in April, 1873.

Tapestry as a Fixture.

THE law in regard to fixtures contains many subtle distinctions, but it is necessary both for architects and builders to have some general idea of it for the protection of clients and employers. We fear that the recent decision on this point, arising out of the difference as to the right to the possession of the late Mme. de Falbe's tapestries at Luton Hoo, will have a tendency to puzzle those who are interested in this matter. Mr. Justice Byrne decided that the tapestry in the drawing-room belonged to the estate, and therefore passed with it; that the tapestry in the hall belonged to the executors and not to the estate, because these pieces were not attached to the wall or fabric of the house in such a way as to constitute permanent additions to the mansion house. Without going into details it may be said that the tapestries in the hall were framed—they were, in fact, very similar to large pictures screwed to the wall. On the other hand, the walls in the drawing-room were prepared for the tapestry by having some thing in the nature of an ordinary canvas and frame fixed to the wall; to these the tapestries were attached. We confess that the fixing of the tapestries in the hall and in the drawing-room appears to the non-legal mind to have been about the same in character. But the Judge, by means of photographs, also came to the conclusion that the tapestries in the drawing-room formed the leading and most characteristic feature of the wall decoration, and one which would be entirely destroyed by their permanent removal. But the drawing-room had once been without tapestries, and we imagine could again be effectively adorned with pictures, so that it appears doubtful if Mr. Justice Byrne's decision as to the tapestries in the drawing-room can be upheld. With all due respect to the learned Judge as a lawyer, his opinion on what is or is not a permanent characteristic of a room is not of as much weight as that of a competent architect or painter.

Landlords and Sanitary Defects.

WE have often had occasion to point out that the law in regard to sanitary matters both in town and country is fairly effective if it be employed, and that the chief point to be insisted on is not reform of the law, but its active application by the Local Authorities. On the other hand, it must be said in justice to sanitary inspectors that their difficulties are greatly increased by the negligence or inertness of house-owners, who, from their position, should take the lead in these matters. Thus, in the Report in the *Watford Observer* of November 24 of the last meeting of the Watford Rural District Council, we find the inspector reporting that a dwelling-house owned by Lord Ebury had among other sanitary defects no intercepting trap between the house and cesspool, no supply of water to the inside water-closet, and the tank waste-pipe required disconnecting from the drain. The Report further adds that after a warning, "nothing has been done to remedy the defects," and that a formal notice must therefore be served. But how can districts be placed in a proper sanitary condition when landlords thus neglect their duty, and by so doing encourage smaller proprietors to fail in keeping their premises in even an elementary state of sanitary fitness? All we can hope is that Lord Ebury is an exception, and that there are few in his position who are so neglectful of their duty as owners of house property.

Electric Oscillations.

LAST Monday evening, Dr. Fleming gave the first of a course of four Cantor Lectures at the Society of Arts on "Electric Oscillations and Electric Waves." He began by defining an electric oscillation as an alternating current of very high frequency. The frequency of ordinary commercial alternating currents is from fifty to a hundred per second, but the frequency of the alternating currents with which the lecturer dealt was sometimes nearly a million per second. It would be quite impossible to produce these currents by coils of wire rotating in a magnetic field. Practically the only way of producing them is by allowing a condenser to discharge itself through an inductive coil. It is highly probable that Professor Joseph Henry, as far back as 1842, recognised that the discharge of a condenser might in certain cases be oscillatory. Lord Kelvin, in 1853, proved analytically that the discharge was sometimes oscillatory, and gave the correct criteria which determine whether it will oscillate or not. Feddersen and many others verified experimentally his conclusions, and the lecturer showed photographs on the screen of the successive sparks that take place when a Leyden jar is discharged. He showed some very striking experiments illustrating what is known as electrodeless discharge. A large vacuous bulb introduced into the centre of a coil of wire carrying a high frequency current instantly became luminous, a bright circular ring of light which appeared to revolve being generated inside the bulb. He showed by a thin sheet of silver foil how easy it was to screen off the bulb from these electric oscillations. In one of his experiments he proved conclusively that iron had a greater choking effect on these high frequency currents than copper, and thus proved that the conclusions of Hertz and Lodge need modification. He gave an interesting experiment on "wireless electric lighting," and, placing himself between the lamp and the source, so that the electric oscillations must pass through his body, showed that they had absolutely no effect on it. The lecture was most successful, and the course promises to be not only of great popular interest, but also epoch-making from a scientific point of view.

Advances in Telegraphy and Telephony.

MR. GAVEY, the electrician to the Post Office, read a paper last week to the Institution of Electrical Engineers on "Telegraphs and Telephones at the Paris Exhibition." He first discussed the improvements in multiplex telegraphy, and showed how, by means of automatic transmission, the carrying capacity of our telegraph lines had been increased by 1,000 per cent. during the last twenty years. A wire which only carried thirty words per minute when the instruments were worked by hand could easily carry 300 words per minute with an automatic Wheatstone. He praised highly the improved telegraph instruments exhibited by Messrs. Virag & Pollak, which produce messages in ordinary writing at the receiving station, thus saving the necessity of having a staff of clerks to interpret the signals. He thought that both in this country and in America we were within a measurable distance of introducing and using a printing and typing telegraph, so that the Morse system would soon be a thing of the past. The advance in telephony has been much more rapid than in telegraphy. He mentioned specially the abolition of the earth return, the use of a central battery, visual signalling and automatic exchanges. The central battery telephone switch of the Western Electric Company is being adopted all over America, and has been adopted by the Post Office and the National Telephone Company. Amongst curious developments

he mentioned the "Telephone Hirmondo" at Buda-Pesth. Items of news are spoken into the main transmitting telephones at the central station every quarter of an hour, and they are repeated until fresh news arrives. Selections of music are also occasionally given. It is a substitute in fact for an evening paper and a theatrophone, and is very successful commercially. Another novelty in telephone working is illustrated in the capital of Mexico, where they have "free trade" in telephones. Any one is at liberty to open a telephone exchange, provided he undertakes to have intercommunication with the others. There are at present eight separate companies at work. The most interesting and the most promising of the inventions in this section shown at the Exhibition was the Poulsen telegraphone. A steel ribbon is made to pass rapidly before the diaphragm of the telephone, and this records the message. On passing this ribbon in front of the diaphragm at any subsequent time the message is repeated perfectly distinctly. In the opinion of the lecturer, Sir William Preece, Dr. Silvanus Thompson, and many others who spoke in the discussion, the Poulsen telegraphone was far superior to the phonograph, and many important possible applications of it were pointed out.

Christ's and St. Bartholomew's Hospitals.

THE Corporation of London, as Governors of St. Bartholomew's Hospital of the foundation of King Henry the Eighth, will promote a Bill in the ensuing session of Parliament to empower them to purchase by either compulsion or agreement the site and buildings of the Blue Coat School, with a view to the extension and improvement of their own hospital and its grounds. The site they propose to acquire abuts upon the hospital's south side, is bounded by Giltspur-street, Newgate-street, and Little Britain, and is situated in the parishes of St. Sepulchre, Christ Church, St. Bartholomew-the Less, and St. Botolph, Aldersgate. It is not commonly known that there formerly existed a foot thoroughfare from Newgate-street to a gate in the City wall, at the north-west corner of the Grey Friars great cloister, and so by "The Walke" to St. Bartholomew's Hospital. The walk and the gate in the City wall are plotted in one of some plans surveyed in and about 1540. The plans also mark a burial ground of Grey Friars as lying to the south-west of the Walk, and just outside the City ditch, with another graveyard for the "Poor of the Hospital" (of St. Bartholomew) within the precincts of the latter. The Walk was closed in 1818, and the gate in the City wall is now represented by a doorway (opening into the remoter hospital) in the north-west angle of "Great Cloister," Christ's Hospital.

Churches in Leeds.

A PARLIAMENTARY Bill is promoted for the constitution of a body of trustees with authority to pull down and dispose of the three churches of St. Paul, St. Philip, and St. Stephen, Burmantofts, together with their several graveyards, vaults, &c., schools and vicarages, also the St. Luke's, St. Thomas's, and St. Barnabas's Schools and St. Edmund's Vicarage, and to apply the proceeds towards the formation and endowment of certain new ecclesiastical districts, with churches, mission rooms, schools, and houses of residence for the incumbents or ministers of the new districts. The church of St. Philip, in Wellington-street, was built in 1846-7, under the Act 6 and 7 Vic. c. 37, at a cost of 5,000*l.*, after the plans and designs of Mr. R. D. Chantrell, of Leeds. The church of St. Stephen, designed by Mr. J. Dobson, of Leeds, was erected in Accommodation-road, 1853-4, and cost about 3,000*l.*; whilst St. Paul's stands upon a site in Park-square given by Dr. Wilson, Bishop of the then diocese of Bristol; it was built of stone at a cost of 10,000*l.* after the classical style with an Ionic portico and pediment and was renovated eighteen years ago.

Society of Painters in Water-colours.

THE thirty-ninth exhibition of the Society of Painters in Water-colours contains an unusually large proportion of interesting works, though several of the leading artists are not quite at their best; Mr. Tom Lloyd, for instance, whose "Sea Pinks, Alderney" (54), is a beautiful and delicately-treated coast scene, but one or two others of his are less interesting than usual. Mrs. Allingham is of course always good, but her contributions this year do not reach her highest standard. The landscape, "Downs near Westerham" (199), is noticeable for the unusual fact that it contains no figures. On the other hand, Mr. Thorne Waite's large drawing "The Lock" (59), in the centre place at the top of the room, is one of the finest things he has done; the only contributor, perhaps, of whom this could be said. Mr. Chas. Gregory's highly-finished but not very powerful style in landscape is well illustrated in "A Primrose Path" (10), a tangle of delicately-coloured foliage; the same effect is repeated in "A Surrey Town" (18). Mr. R. W. Allan contributes several of his broad bright effects of colour and sunlight, of which perhaps the best is "Montrose" (45); in the otherwise powerful drawing of "Honfleur" (26) the architectural detail is too much sacrificed to the total effect, considering what a prominent feature the church front is in the composition. Mr. Matthew Hales's "Sunset and Sunrise, North Cape" (20) is a brave attempt at a most difficult subject, an expanse of sea catching a red glow from the sky. Mr. Pilsbury's beautiful finish in landscape is best shown in "The Fall of the Leaf" (22), a most delicate and painstaking piece of work, except perhaps in regard to the water, which seems rather neglected, at all events not wrought up to the finish of the rest. In contrast with his work we have the finer and more poetic treatment of Nature by Mr. Eyre Walker; among his drawings may be especially noticed "The South Downs, from Ashdown Forest" (134), for truth of light, colour, and distance, and a true broad water-colour style. Miss Rose Barton exhibits two pictures of an old garden with masses of clipped hedges, fine in general effect, but there is a want of texture in the clipped hedges, which might be almost any material. Mr. Cuthbert Rigby, who may be classed with Mr. Eyre Walker as a landscape painter, contributes seven works, of which "Rainsborrow Crag" (185) is the most striking. Architectural subjects enter pretty largely into the collection; Mr. Albert Goodwin has a view from the roof of Milan Cathedral, a splendid subject, which wants a more forcible treatment of foreground detail to make it fully effective; Mr. Rooke, besides some small drawings in which buildings predominate, sends a large and really fine architectural picture of "Senlis Cathedral" (191). Mr. Walter Crane's small landscape sketches are interesting, especially "Dunwich" (72), which gives a remarkably true impression of the place; but why did he send in such a thing as "An English Rose" (57)? and why, if he sent it, was it hung? Among other works which should not be passed over are Mr. Herbert Marshall's "A Grey Morning, Whitby" (111); Mr. Hemy's "Study from Nature for the Boat in the 'St. Mawes'" (95); "A Study in Colour" (178) by Mr. Thorne Waite—flowers in a green vase; and "Goldsmith awaiting Dr. Johnson" (218), by Mr. Smallfield. The introduction of a cartoon for stained glass (179), by Mr. Louis Davis, although the work itself is very good, seems rather out of place in an exhibition of this kind.

Mr. Moffat Lindner's Exhibition.

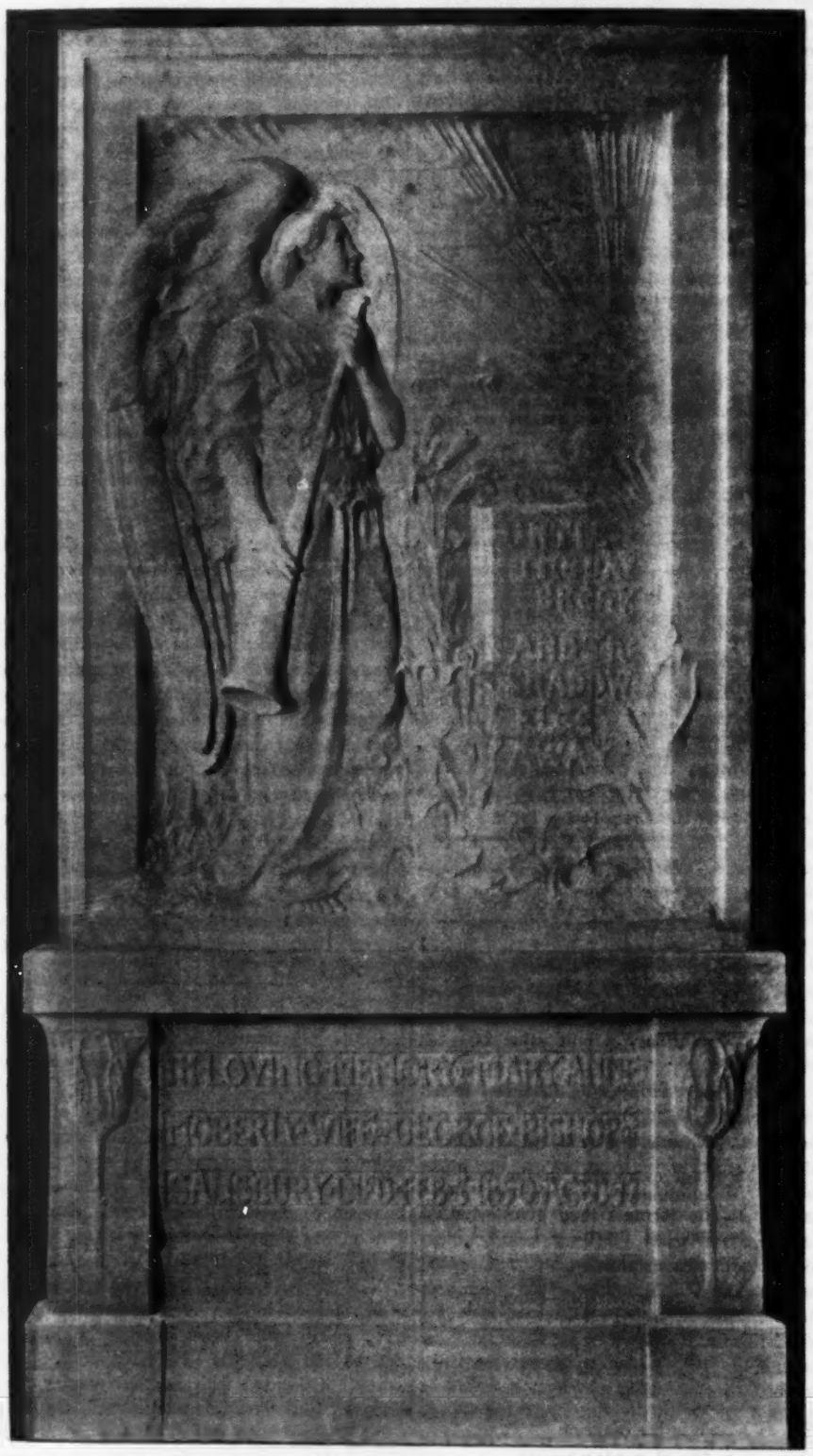
AT Mr. Dunthorne's Gallery in Vigo-street is a small collection of water-colour sketches by Mr. Moffat Lindner of "The Harbours of Bergen and the Rivers of Dordrecht." These are rapid impressions of the light and colour of scenes in most of which shipping craft of various kinds form the prominent features; they are very interesting as suggestions or records of effect, except that the water is almost entirely neglected—apparently regarded as a white surface on which to plant ships. No. 4, for instance, is called "A Good Breeze," but where is the effect of the breeze on the water? It is left to the imagination: and in a breeze the general effect of water is usually dark rather than light.

Camberwell School of Arts and Crafts.

THIS school has just held its first annual exhibition of students' work from November 20 to 26. The school was opened in January 1898, in a building erected in memory of Lord Leighton by the Vestry of Camberwell, in order to provide instruction in those branches of design and manipulation which directly bear on the more artistic trades. The exhibition was supplemented by cases of the more finished productions of the Central School of Arts and Crafts in Regent-street, which added to the interest of the exhibition, and should have been very instructive to the students of Camberwell. The school is divided into sections under "art classes" and "technical classes." On both sides there is evidence of a good beginning having been made. The art classes are confined to figure drawing and design, the best results of which seem to be in pen and ink studies, those by Mr. R. Richardson and Miss M. Ballard being among the list. On the technical side there is a fair show of work done. In the embroidery exhibits there is an evident lack of study of the design and colour of old work; there is a certain rawness even in the best work done in this class. Of the other classes there is no remarkable exhibit, unless it is in the practical cabinet-making class, where Mr. H. Martin has made an overmantel, very fair in design and apparently of sound workmanship; there is some good inlay in this class by Mr. G. W. Cole.

Hindley Public Offices Competition.

THE instructions issued to architects for this competition form a more curious example than usual of the ignorance with which such



Memorial Tablet, Salisbury Cathedral. Miss E. M. Rope, Sculptor.

documents are drawn up by small public bodies who seek no advice beyond that of their own surveyor. To begin with, the sum named, 5,000*l.*, is utterly inadequate for the building required. The Council will make their own selection of what they think the three best designs, and give premiums of 50*l.* 25*l.* and 10*l.*, for which sums all these three sets of drawings "are to become the property of the Urban District Council of Hindley, who are not to be bound in any manner by anything done under, or in connection with, the competition, beyond paying the premium." Finally, and as a crowning insult to the profession, it is added, "Each competitor must state the terms upon which he would be prepared to superintend the carrying-out of his plans." What architect of any standing or respectability do the Council expect will compete on those terms?

MONUMENTAL TABLET IN SALISBURY CATHEDRAL.

THE tablet with inscription, illustrated here, has just been put up in Salisbury Cathedral to the memory of Mrs. Moberly, widow of the late bishop of the diocese. It is of white marble, measuring 5 ft. in height and 2 ft. 7 in. in width, and is placed upon the plinth against the south wall of the south-east transept, adjoining the monument to Bishop Burgess. The sculpture represents a figure of an angel standing watching for the dawn of the Resurrection morning. In the right corner is a stone bearing the inscription, "Until the day break and the shadows flee away." The dedicatory inscription occupies the plinth of the monument.

The work was designed and modelled by Miss E. M. Rope.

MORTAR FROM SILCHESTER.

IN continuation of his researches respecting the chemical composition of ancient mortar as existing in our old abbeys, castles, and Roman ruins (see *Builder*, June 18, 1892, and February 11, 1893), the writer has much pleasure in sending the following analysis of a specimen of mortar taken from the old Roman camp at Silchester, together with a photo-micrograph of the sand magnified twenty-five diameters, which was taken by the writer's chief assistant, Mr. Albert Ashe, whose name was associated with the previous illustrations :—

Analysis of Mortar from Roman Camp at Silchester.

Water (lost at 212° Fahr.)	1·46
Combined Water	2·68
Lime	22·70
Magnesia	·23
Potash	·36
Soda	·15
Oxides of Iron	1·95
Alumina	·30
Sulphuric Acid	·08
*Carbonic Acid	15·46
Gelatinous Silica soluble in Alkali	12·10
Insoluble Matters (Sand), &c., &c.	42·33
	100·00

On comparing the above results with those published in the *Builder* of the dates referred to, also with the analysis of mortar from Peterborough Cathedral published in the issue of February 20, 1897, it will be seen that this mortar is of exceptionally good quality, for not only is the lime present in high proportion to the sand, namely, as 1 to 1·86, but the figures for gelatinous silica soluble in a 10 per cent. solution of caustic soda are also exceptionally high—namely, 12·10 per cent.

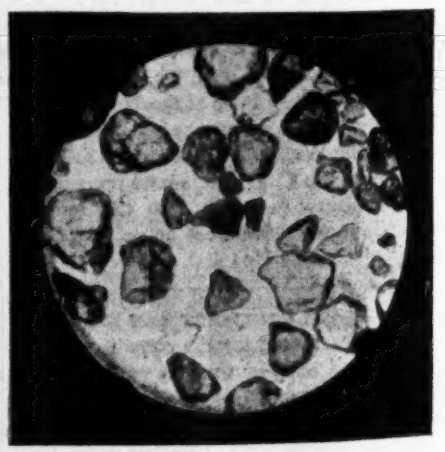
In commenting upon the mortar from Peterborough Cathedral, attention was drawn to the fact that a high percentage of lime was not necessarily an indication of the superior quality of mortar, for though there was as much as 28·25 per cent. of lime present in the Peterborough specimen, the mortar was of very inferior quality, much of the lime being due to the calcareous nature of the small stones and gravel, consisting largely of cretaceous chalk, associated with the original mortar.

The figures for gelatinous silica in the Peterborough mortar only amounted to 3·55 per cent., or about one-fourth of the quantity found in this mortar.

It is really the proportion of gelatinous silica associated with the lime that constitutes, in the writer's opinion, the best test of the quality of mortar; and it would be of practical interest to ascertain the particular locality from whence the lime used in the preparation of the Silchester mortar was obtained, because the gelatinous silica is usually associated with the lime rather than with the sand employed.

Chalk lime contains only 1 to 2 per cent. of soluble silica, greystone contains 9 to 10, Aberthaw 15, while the best Portland cement contains as much as 20 to 22 per cent.

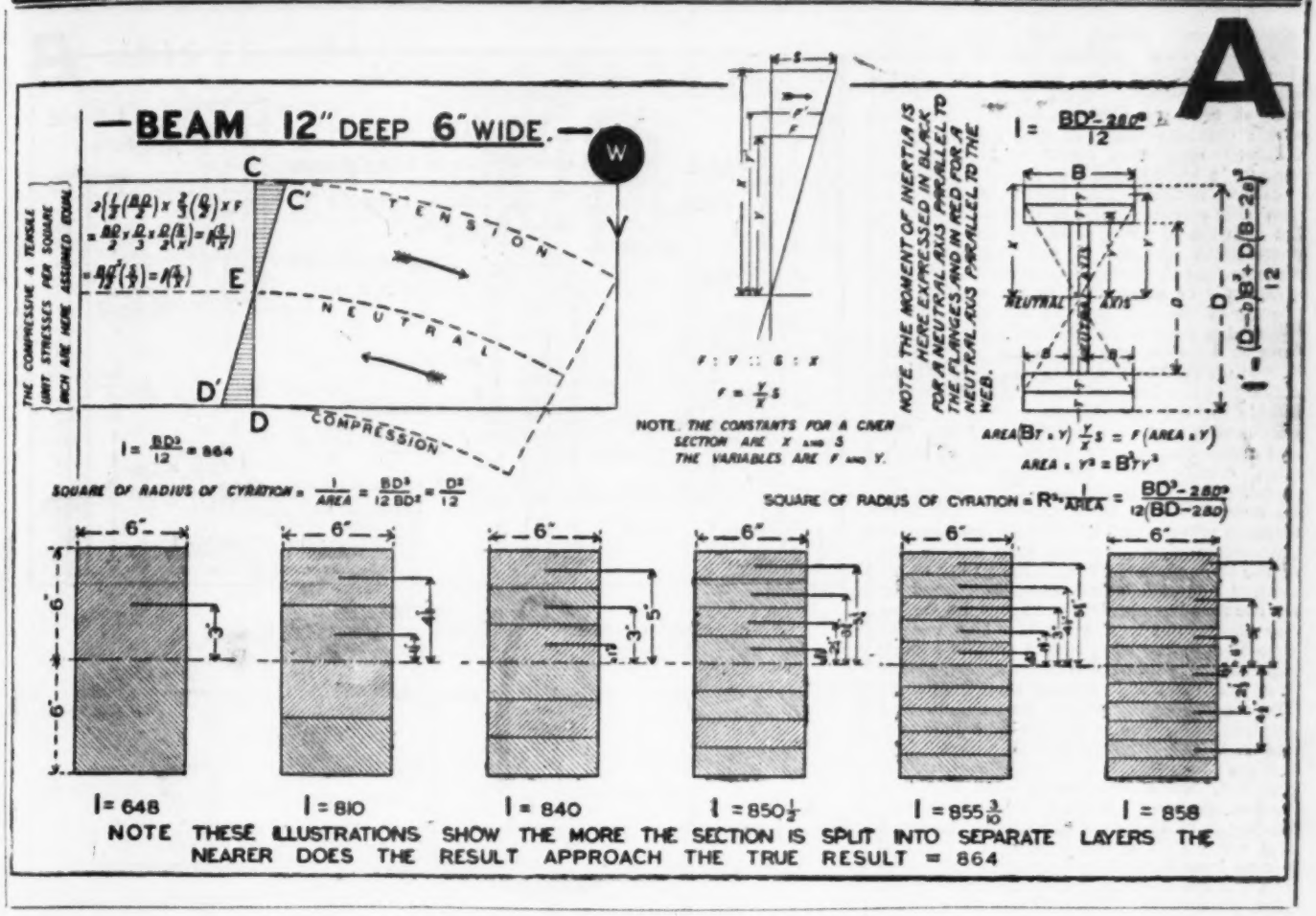
As regards the sand employed in this mortar, the illustration shows that it is of good quality,



Specimen of Sand used in the Mortar, Magnified 25 Diameters.

being fairly uniform in size, with irregular rough edges, and very different from the smooth rounded shape and water-worn appearance so graphically illustrated in respect

* Equal to carbonate of lime, 35·13.


A
BEAM 12" DEEP 6" WIDE.
W
C
C'
TENSION
NEUTRAL
E
D'
D
COMPRESSION
THE COMPRESSIVE & TENSILE UNIT STRESSES PER SQUARE INCH ARE HERE ASSUMED EQUAL
I = BD³/12 = 864
SQUARE OF RADIUS OF GYRATION = I/AREA = BD³/12BD² = D²/12
F : V :: S : X
F = V/X S
NOTE. THE CONSTANTS FOR A GIVEN SECTION ARE X AND S
THE VARIABLES ARE F AND Y.
NOTE THE MOMENT OF INERTIA IS HERE EXPRESSED IN BLACK FOR A NEUTRAL AXIS PARALLEL TO THE FLANGES AND IN RED FOR A NEUTRAL AXIS PARALLEL TO THE WEB.
I = (BD³ − 2bD³)/12
I' = ((D−b)B³ + D(B−2b)³)/12
NEUTRAL AXIS
AREA (By) y/x S = F (AREA y)
AREA y² = By³
SQUARE OF RADIUS OF GYRATION = R² = I/AREA = (BD³ − 2bD³)/12(BD − 2bD)
6"
I = 648
I = 810
I = 840
I = 850½
I = 855 3/10
I = 858
NOTE THESE ILLUSTRATIONS SHOW THE MORE THE SECTION IS SPLIT INTO SEPARATE LAYERS THE NEARER DOES THE RESULT APPROACH THE TRUE RESULT = 864

of the sand in the mortar of Rochester Castle (*Builder*, June 18, 1892).

Of minor importance, but for the sake of comparison, it is interesting to notice that the figures for magnesia, oxides of iron, alumina, and sulphuric acid are all low in this Silchester specimen of mortar.

JOHN HUGHES, F.I.C.,
District Agricultural Analyst for Herefordshire.

THE ARCHITECTURAL ASSOCIATION.

AN ordinary fortnightly meeting of this Association was held on Friday last week in the Meeting Room of the Royal Institute of British Architects, No. 9, Conduit-street, Regent-street, W., the President, Mr. W. H. Seth-Smith, in the chair. On the invitation of the Committee of the Association, a large number of members of the Institution of Junior Engineers were present, and the meeting room was more than usually crowded.

The minutes of the last meeting having been read and confirmed,

Mr. G. B. Carvill, hon. secretary, announced some donations to the library.

The following gentlemen were then elected members of the Association: Messrs. R. P. Jones, J. F. McIlwraith, P. W. Mulready, J. M. Pilkington, and S. N. Simmons.

The Use of Rolled Joists in Construction.

The Chairman, in calling on Mr. A. T. Walmisley to read a paper on "The Use of Rolled Joists in Construction," said that Mr. Walmisley had been very unwell lately, and it had been a special effort for him to prepare his paper for the occasion; consequently they would feel the more indebted to him for the trouble he had taken in the matter.

Mr. A. T. Walmisley, before reading his paper, described some diagrams which he had had prepared for the occasion, and which are reproduced in this issue of the *Builder*, after which he read the following paper:—

"It is necessary, in the first place, to understand the influence of the moment of inertia when considering the moment of resistance of a section.

Referring to diagram A, fig. 1, maximum stress (tensile), CC'. Maximum stress (compressive) DD'.

If in fig. 2, S = safe stress per sq. inch in the outside fibre CC' or DD' and x = its distance from the neutral axis and b (see fig. 3) = breadth and t = thickness of layers in section, then bt = area = a, and if y or y' = distance of centres of area from the neutral axis, moment of resistance of outside plate or layer = $(a \times y)\frac{y}{x}S = f(a \times y)$, because the strain being zero at E and a maximum at a distance x from E, it will at a distance y from E have a unit value of $\frac{y}{x}S$, which, multiplied by the area, gives the total strain in the layer acting at a distance y from the neutral axis.

$(a \times y)\frac{y}{x}S$. Now x and S in this equation being constant for every area in the section, they can be eliminated and applied after summation. The formula then gives what is called the moment of inertia = $I = Ay^2$ and $\frac{I \times S}{x}$ = moment of resistance.

Typical Section, 12 in. × 6 in.—Calculated by the formula $\frac{bd^3}{12}$ we find

$$I = \frac{6 \times 1728}{12} = 864$$

and referring to the dividing up of the above section as shown in the diagram,

$$I = 36 \times 3^2 = 324 \times 2 = 648$$
$$I = 18(4.5^2 + 1.5^2) = 405 \times 2 = 810$$
$$I = 12\ (5^2 + 3^2 + 1^2) = 420 \times 2 = 840$$
$$I = 9(5.25^2 + 3.75^2 + 2.25^2 + .75^2) = 425.25 \times 2 = 850.5.$$
$$I = 7.2(5.4^2 + 4.2^2 + 3.0^2 + 1.8^2 + .6^2) = 427.68 \times 2 = 855.36.$$
$$I = 6(5.5^2 + 4.5^2 + 3.5^2 + 2.5^2 + 1.5^2 + .5^2) = 429 \times 2 = 858.$$

The above trials show that in proportion to the number of horizontal sections taken, the nearer to the truth will be the result.

The late Sir William Siemens, addressing the Iron and Steel Institute in 1877, stated that the use of steel for structural purposes could only be said to date from the year of the Great Exhibition of 1851. Its manufacture is now well understood. It is found to be a complex structure, and not the homogeneous mass it is often supposed to be. Addressing the Iron and Steel Institute this year (1900) Sir William Roberts Austen stated that "in 1,000 parts of steel, 997 parts, more or less, may be iron and the rest carbon," but that the result of the union is a metal that is more widely used and has more varied attributes than any other material.

The interdependence of small percentages of matter on the larger masses in which such minute contributions are hidden is one of the chief studies of metallurgists of the present day, and the chemistry of steel shows the effects produced by the existence of phosphorus, silicon, manganese, and sulphur in the material, rendering some kinds of steel comparatively soft, while others were extremely hard. The mode adopted for either rapid or slow cooling was seen to have an influence. The committee appointed by the Board of Trade to inquire into the loss of strength in steel rails through use on railways, consequent on the St. Neots accident of December 10, 1895, after four years' labour in their report issued this year state that, as regards chemical composition, they do not think it desirable to insist upon too high a proportion of carbon, manganese, or silicon in the steel, having regard to the ordinary contingencies of manufacture and the greater susceptibility of high carbon steel to thermal influences, but beyond giving tabular results of investigation of individual specimens, the committee, while establishing the conclusion that the evidence is not sufficient to justify a decisive verdict respecting percentages, nevertheless insist on the importance of securing as low a proportion as possible of phosphorus, sulphur, and silicon in steel which is to be manufactured into rails, and these precautions would apply in a similar way to rolled joists.

The St. Neots rail was a Bessemer steel (80 lbs. per yard) bull-headed rail, laid in 1873 on the Great Northern Railway up line, and transferred to the down line after thirteen years' service on the up line during repairs at some date not recorded. Its failure may have been due to local stresses unavoidable at the joints, and independent of the chemical composition of the steel, but which joints need constant periodical inspection.

Although iron does not combine with carbon at ordinary temperatures, yet the union may be effected when brought into contact at a red heat. Mild steel containing a proper percentage of carbon is produced by the Bessemer as well as by the open hearth processes both with either acid or with basic lining to the convertor or hearth. The open hearth process is more under control, and gives more time to adjust the composition than the Bessemer converter, and hence is generally preferred. In the Bessemer or pneumatic process, molten pig-iron is blown through, the carbon and other elements burned out, and then the desired proportions of carbon and man-

e

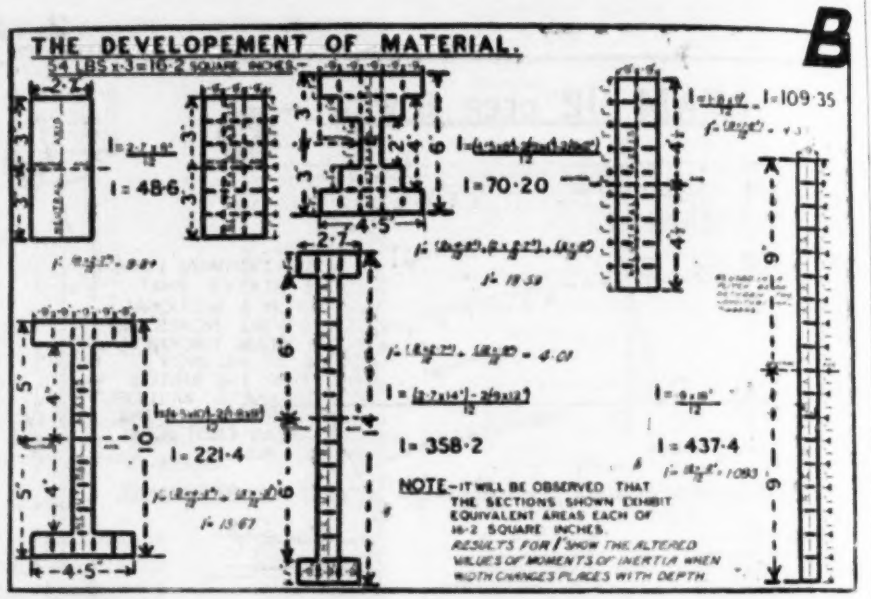
ganese are added, and the whole process is over in, say, twenty minutes. Hematite pig-ron is used in connexion with acid linings. With silicious linings such as ordinary firebrick, basic slag would would combine with it and eat it away. Calcined magnesian limestone is generally used for a basic lining, and hence the process is called basic. We have the treatment of pig-iron with certain classes of iron ores without the addition of scrap, according to the direct open-hearth process of the late Sir Wm. Siemens, and the fusion of a mixture of pig and scrap iron or scrap steel in the open-hearth process of Messrs. Siemens-Martin, in which the steel is dead melted and the process allows time to draw samples for testing and time to doctor up the mixture as required. Pig irons containing but little carbon or silicon are preferable for the open-hearth process. Phosphorus aids cold shortness, *i.e.*, breakage cold and unexpectedly, while sulphur aids red shortness. A deficiency of silicon results in inferior metal. Only the purer kinds of pig-iron can be operated upon in silicious or acid-lined furnaces, while with basic linings, more impure phosphoric pig-irons can be used, and the slag of the basic process contains from 10 to 18 per cent. of phosphoric acid, which is ground up for use as a fertiliser. The higher the carbon the higher the tensile strain. This can be regulated in the open-hearth process without expense. For thin material the carbon is kept low, and for thick material it is kept high. The operation of rolling hardens it. The sulphur and phosphorus should be below ·06 per cent. The lower the steel is in phosphorus, the less susceptible is it to crystallisation when punched. Some experiments upon bars 2 in. by $\frac{3}{4}$ in., punched with a $\frac{3}{4}$ in. diameter hole, leaving $\frac{1}{16}$ in. clearance, were made upon acid and upon basic open-hearth steel. The acid system gave bars with ·08 per cent. phosphorus, and the basic system gave bars with ·03 per cent. phosphorus. The acid bars were broken by the process, and were found to have crystallised from the punch-hole to the edge of the bar. The basic bars showed no effect of the punching. Both the acid and basic steel experimented upon was ordinary structural steel running from ·2 to ·3 per cent. of carbon. Experience shows that the lower the phosphorus, other elements being the same, the less is the steel affected by cold working. The connexions in all steel work is preferably made in holes carefully drilled.

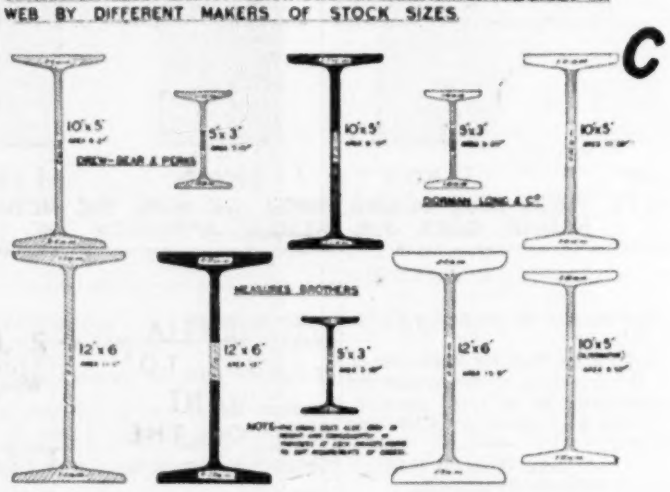
Messrs. Dorman, Long, & Co. (Middlesbrough) adopt a proportion of between 0·16 and 0·25 per cent. carbon in their steel by the Siemens-Martin process. Owing to the supplies of the best hematite ores becoming scarce, the quality of this kind of ore is inferior to what it was a few years ago, and it is very difficult to keep the sulphur and phosphorus below expedient limits. This is one of the reasons which has led Messrs. Dorman, Long, & Co. to adopt the manufacture of steel from Cleveland iron, the phosphorus being eliminated by lime and the sulphur by calcium chloride. They find that they are able to obtain better results than they could with the old hematite iron, and by keeping records of frequent analysis, and having meanwhile the furnace under control, they supply the sections which give satisfaction.

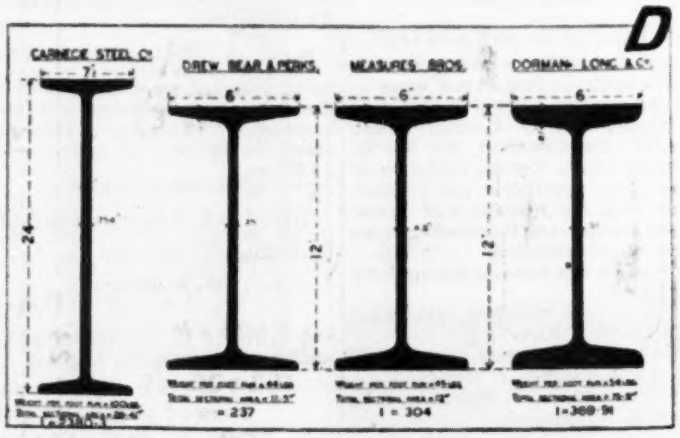
At the Earl of Dudley's Round Oak Iron and Steel Works, Brierley Hill, they adopt the basic open hearth process, and can produce anything from ·1 to ·3 carbon that punches cleanly and works satisfactorily. The Shelton Iron and Steel Company also adopt the basic open hearth process.

A large number of joists used in construction are too shallow. The proportionate depth to the span should be $\frac{1}{18}$, but should never be less than $\frac{1}{20}$ of the span. The advantage of depth over width is shown in diagrams E and F. To the former we shall allude presently, but in the common form of placing one stock section over another it will be seen upon reference to diagram F that the flanges which are united in the centre do not materially assist the moment of inertia of the section. Hence the tendency to deflection obviated by the use of two joists employed as shown in diagram F could be better provided for by the adoption of a made-up girder with angle-irons and plates in which the metal of the double centre could be transferred to the top and bottom flanges. When girders have to carry a floor to which a plastered ceiling is to be suspended, comparative stiffness is indispensable to prevent sagging, and the consequent cracking of the plaster, and should be designed under such circumstances so that the deflection does not exceed $\frac{1}{360}$ in. per foot of span, but this ratio might even be reduced with advantage.

Makers' catalogues show the sizes and weight of joists kept in stock, and in some cases add the safe distributed loads over various spans for each joist, but do not state the breaking strain assumed, or if they do give this, they do not add the factor of safety taken to arrive at the amount of stress per square inch. Hence it is not generally fair to say that because one list gives higher loads than another list that the joists are superior. In each case the designer must determine the safe working load for himself, and see that both the flanges and the web are each capable of sustaining their due proportion of strain. The joists sometimes come in from the mills not as true as one could wish, the flanges not being parallel. This is more noticeable in the wider sections, the 8 in. by 6 in. especially. Such wide sections, also 9 in. by 7 in., are more suitable for stanchions than girders.


B
THE DEVELOPEMENT OF MATERIAL.
I = 48·6
I = 109·35
I = 70·20
I = 221·4
I = 358·2
I = 437·4
NOTE—IT WILL BE OBSERVED THAT THE SECTIONS SHOWN EXHIBIT EQUIVALENT AREAS EACH OF 16·2 SQUARE INCHES
RESULTS FOR I SHOW THE ALTERED VALUES OF MOMENTS OF INERTIA WHEN WIDTH CHANGES PLACES WITH DEPTH


DIAGRAMS ILLUSTRATING VARIATIONS IN AREAS OF FLANGES & WEB BY DIFFERENT MAKERS OF STOCK SIZES.
C
DREW, BEAR & PERKS
DORMAN LONG & Co
MEASURES BROTHERS



When a wide dimension is needed for girder work, for the support of a wall or other purposes, two rolled joists are introduced as shown in diagram E, which illustrates the effect of adding top and bottom flange plates to form the connexion, and shows the theoretical corresponding thickness of web that would be equivalent to the work of ordinary flange plates. As a rule, in single joists the width of the flange should be sufficient to resist flexure in a horizontal, plane, or lateral bending. When the boom is of insufficient width the girder will fail by the lateral deflection of the top bay or boom rather than vertical buckling.

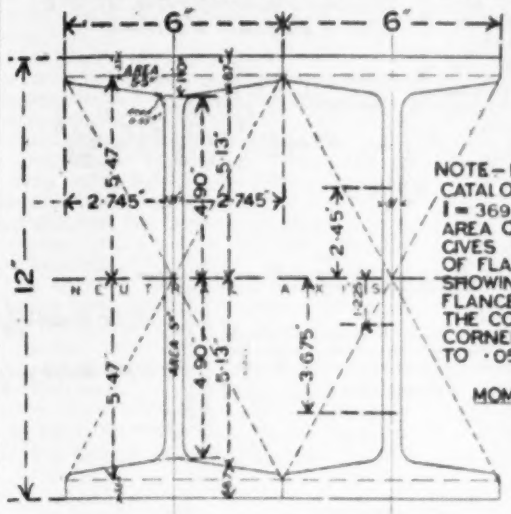
Professor Rankine has deduced the following formulæ for the ultimate strength of the top booms of small girders as regards resistance to lateral flexure :—

$$t = \frac{f}{1 + a\,r^2}$$

where t=the ultimate average thrust per square inch upon the flange area.

2 JOISTS 12″ x 6″

SECTIONAL AREA = 16″ x 2 = 32″
WEIGHT PER FOOT RUN = 54 LBS x 2 = 108 LBS.



NOTE—MESSRS DORMAN LONG'S CATALOGUE STATES THAT I = 369·91 FOR A SECTIONAL AREA OF 15·9 SQ. INCHES AND GIVES THE MEAN THICKNESS OF FLANCE AS ·87 INCH SHOWING THAT THE STATED FLANCE THICKNESS INCLUDES THE CONSIDERATION OF THE CORNER AREAS EACH EQUAL TO ·05 SQ. INS.

MOMENT OF RESISTANCE

$$R = \frac{I \times S}{\frac{1}{2}D}$$

AREAS		DEPTH		AREAS		DEPTH	
5·5″	X	5·47²	= 164·564	5·5″	X	5·47²	164·564
2(05)″	X	4·90²	= 2·401	2(05)″	X	4·90²	2·401
2·5″	X	2·45²	= 15·006	(1·25″	X	3·675²	10·682
			181·971	(1·25″	X	1·225²	1·875
							189·722

$$I = \frac{2}{363{\cdot}942} \qquad I = \frac{2}{371{\cdot}444}$$

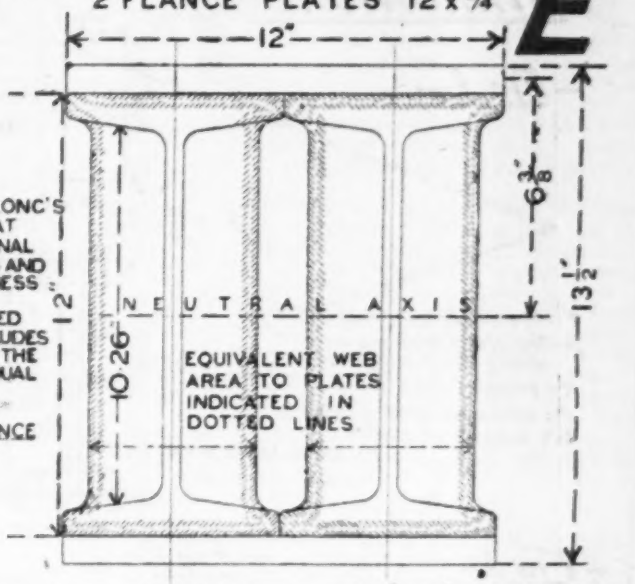
$$I = \frac{(6 \times 12^3) - 2(2{\cdot}745 \times 10{\cdot}26^3) + 4(05 \times 4{\cdot}9^3)}{12} \qquad I = 374{\cdot}68$$

$$I = 369{\cdot}88 + 4{\cdot}80 = 374{\cdot}68$$

$$I = 749{\cdot}36$$

2 JOISTS 12″ x 6″
2 FLANCE PLATES 12″ x ¾″

E



I FOR 2 R.S. JOISTS 12″ x 6″ = 749·36

I′ FOR 2 FLANCE PLATES 12″ x ¾″ =

$$= 2\left\{12 \times \tfrac{3}{4} \times \left(6\tfrac{3}{8}\right)^2\right\}, \text{ OR } \frac{(12 \times 13\tfrac{1}{2}^3)}{12} - \frac{(12 \times 12^3)}{12} = 732{\cdot}37\tfrac{1}{2}$$

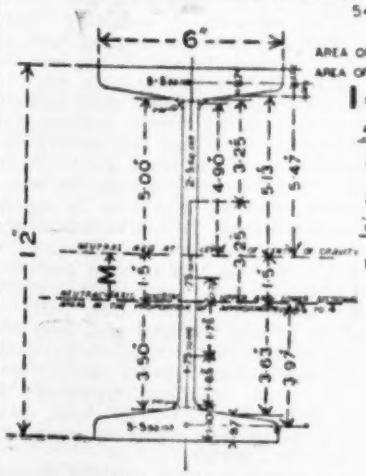
THEN $I + I' = 749{\cdot}36 + 732{\cdot}37$

$= 1481{\cdot}73$

EXAMPLE OF MOMENT OF INERTIA CONSIDERED WITH REFERENCE TO NEUTRAL AXIS NOT COINCIDENT WITH CENTRE OF GRAVITY OF THE SECTION.—

JOIST 12″ x 6″ WEIGHING 54 LBS PER FOOT RUN

54 LBS x 3 = 16·2 SQ. INS



AREA OF PORTION ABOVE NEUTRAL AXIS = 8·85″
AREA OF PORTION BELOW NEUTRAL AXIS = 7·35″

I = 363 (SEE DIAGRAM E)

AREAS		DEPTH	
5·5	X	6·97½ =	267·19
2(05)	X	6·40² =	4·09
3·25	X	3·25² =	34·32
1·75	X	1·75² =	5·36
2(05)	X	3·40² =	1·15
5·5	X	3·97½ =	90·69
16·2			396·79

$16{\cdot}2 \times (1{\cdot}5)^2 = 16{\cdot}2 \times 2{\cdot}25 = 36{\cdot}45$

$I' = I + \text{AREA} \times M^2$

$I' = 363 + 36$

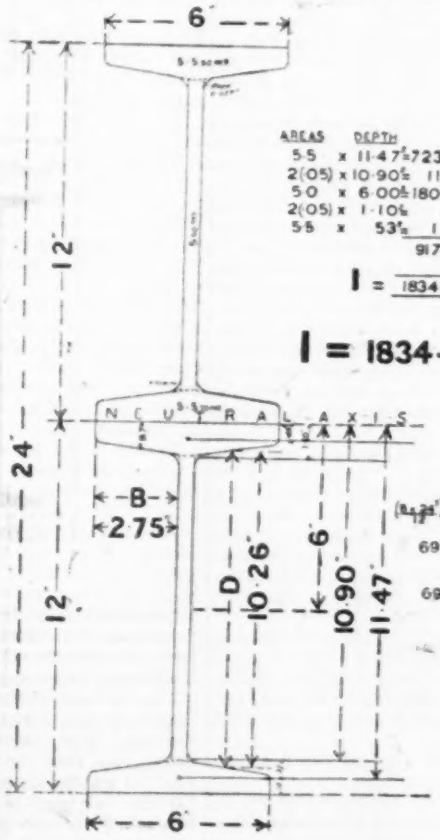
$I' = 369$

HENCE THE MOMENT OF INERTIA CONSIDERED WITH REFERENCE TO A NEUTRAL AXIS SITUATED AT A VERTICAL DISTANCE M FROM THE CENTRE OF GRAVITY EQUALS THE MOMENT OF INERTIA CONSIDERED WITH RECARD TO THE CENTRE OF GRAVITY PLUS THE AREA OF THE SECTION MULTIPLIED BY THE SQUARE OF M ——

— 2 JOISTS 12″ x 6″ —

SECTIONAL AREA = 16″ x 2 = 32″
WEIGHT PER FOOT RUN = 54 LBS x 2 = 108 LBS

F



AREAS		DEPTH	
5·5	x	11·47½ =	723·584
2(05)	x	10·90½ =	11·881
5·0	x	6·00½ =	180·000
2(05)	x	1·10½ =	1·21
5·5	x	53½ =	1·544
			917·130

$$I = \frac{2}{1834{\cdot}260}$$

$I = 1834{\cdot}260$

$$\left(\frac{8 \times 24^3}{12}\right) - 2\left(\frac{2{\cdot}75}{12}\right)\left[2(10{\cdot}26 + 6)^3\right] + 2(5{\cdot}5) = 55^3$$

$6912 = \frac{11}{24}(22{\cdot}26)^3 + 3{\cdot}08$

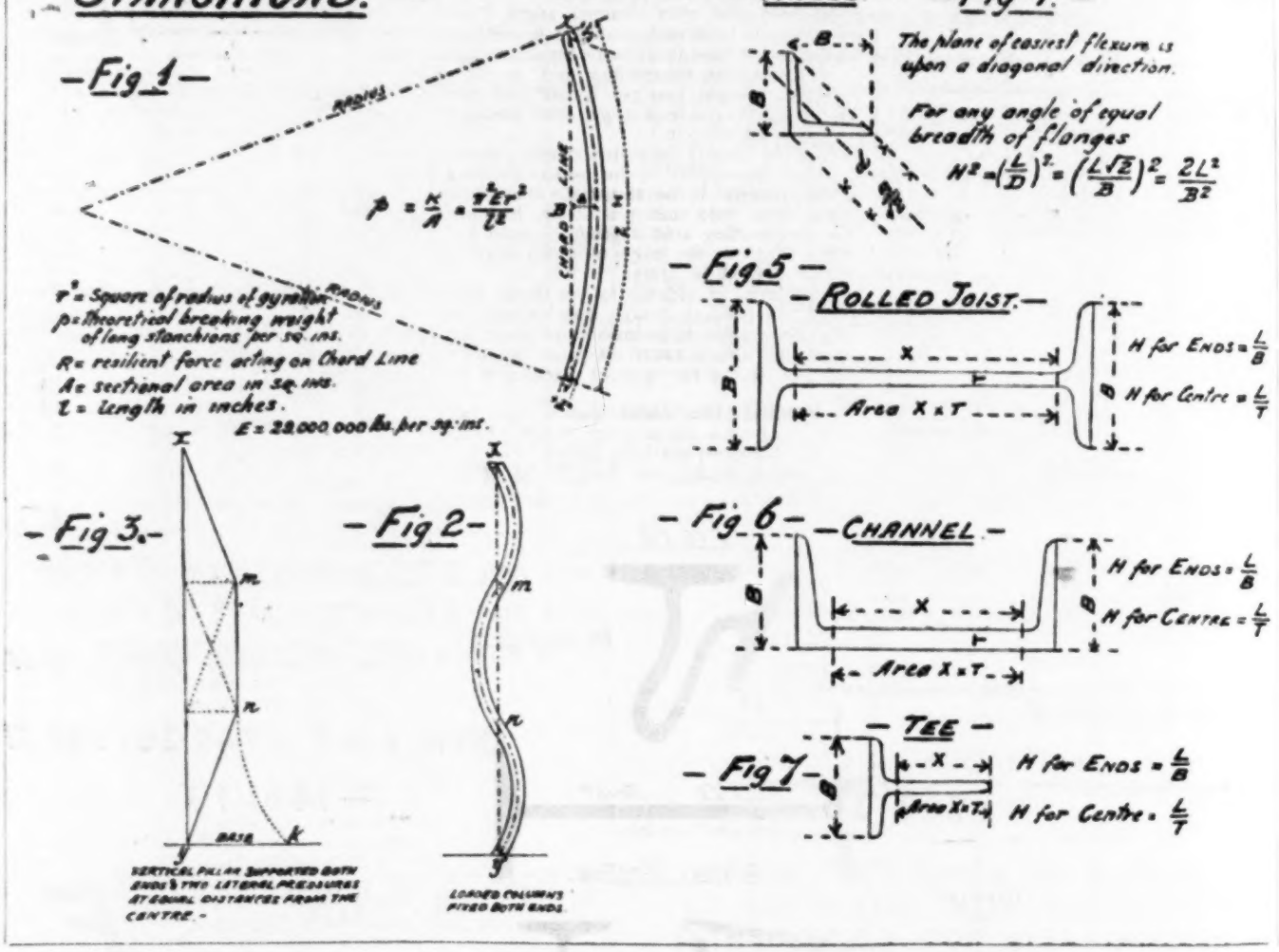
$6912 = 5056 + 3 = 1859$

$I = 1859$

r = the ratio of length of flange to width.
f = 16 tons per square inch or such other value to suit the material in use.
a = a constant which equals $\frac{1}{5000}$ for a flat boom.

When more than a single girder is employed, if the circumstances are such as to admit of the flanges being braced horizontally together like a horizontal lattice girder, not only material may be saved, but the advantage of the inside surfaces of the girders that are so connected is secured for inspection and for facility of forming the connexions.

Generally speaking, the width of the upper flange of a girder, when not stiffened laterally



by additional connexions, should be $\frac{1}{15}$ to $\frac{1}{25}$ of the span, so that if the depth is assumed as $\frac{1}{12}$ of the span the width would be $\frac{1}{2}$ of the span, showing that if the usual stock sizes be taken of 10 in. by 5 in., or 12 in. by 6 in., the proportion of half the depth for the width of flange is ample. The width of the lower flange needs to be such as will give a proper bearing on the piers, or if the beam is suspended from the top flange, a sectional area to resist the tension produced by the loads. It is useful to remember that in long girders the web of a joist is more likely to fail near the points of support than in the centre, not only on account of the action of shearing strain, but on account of the conditions of rolling. Hence at the works it is found well to crop off the ends after rolling long lengths so as to obtain a more uniform strength of section throughout.

In connecting rolled joists at right angles to one another, when one is "machine special notched," a good distributing bearing for the transverse joist upon the lower flange of the longitudinal joist is secured at the connexion. This is illustrated on the diagrams G and H hung on the wall; in the former the web only is cut, in the latter the flange to secure the desired bearing.

In considering bearings, girders should rest on a wall, and not merely upon a pier attached to a wall. The writer has seen girders resting upon what appeared like a pier in plan, but which had simply been brickwork corbelled out.

The higher the wall the less the pressure from the girder upon the ground.

Where joists rests on timber, masonry, or brickwork, bearing plates are invariably introduced to distribute the weight, and such plates should be thick enough to countersink the rivets of attachment to the joists on the under side of the bearing plates. When such plates are set back from the front edge of the wall or stone on which they are placed they exercise the same effect as chamfering the edge of the template.

In the Paris Exhibition of 1867 a rolled beam was exhibited measuring 1 metre (39⅜ in.) in depth, 10 metres (33 ft.) in length, and weighed 2¼ tons. This beam, instead of being rolled in the usual way, was subjected to the pressure of four rollers, by which process the quality of the iron in the flanges was preserved as well as that of the web.

The Carnegie Steel Company roll a beam 24 in. by 7 in. to 80 lbs. per foot and moment of inertia = 2,087. Their joists generally present a good finish free from surface imperfections and straight. The American joists hitherto seem to contain a slightly larger amount of phosphorus in their composition than the British manufacture. They give, for example, a test of 0·08. Ours is about 0·06. The Americans have, however, practically discontinued manufacturing acid open hearth steel, and now make only basic steel, which they assert to be purer chemically. The American joists are at present cheaper than the English, but this, of course, is only peculiar to the moment.

French joists to a reasonable specification are fairly satisfactory, but are not much cheaper than our own when the cost of carriage is added. They adopt the Siemens-Martin basic system. There is nothing fixed for the percentage of carbon, phosphorus, silicon, manganese, or sulphur. Tests are applied by the engineer during use to test hardness and other requirements. They specify 32 kilogrammes per square millimetre, with an elongation 8 per cent. for iron and 42 kilogrammes per square millimetre (26·6 tons per square inch) for steel.

The first national work in this country in which foreign iron was employed was the Natural History Museum, South Kensington, about the year 1869. The term "Belgian joist" is a generic term, as joists are made in France and Germany as well as in Belgium, and sold as foreign joists.

Results of 1,200 Tests of Foreign Steel Joists.

Limit of elasticity	Maximum	69·0 %
	Average	64·1 %
	Minimum	60·0 %
Ultimate stress in tons per square inch	Maximum	29·1 tons.
	Average	28·08 "
	Minimum	27·2 "
Elongation per cent. in 8 in.	Maximum	28·0 %
	Average	24·32 %
	Minimum	20·5 %
Reduction of area per cent.	Maximum	60·2 %
	Average	50·53 %
	Minimum	42·4 %

The above were German manufactur

Observe how even are the results recorded, due probably to the fact that the Germans are good chemists.

As to British, German, Belgian, and American make, all these countries have manufacturers whose output is thoroughly good and reliable. There is no difficulty in obtaining foreign material that will stand the required tests, and the result of foreign competition has been that many of the British rolling mills who roll joists are now better equipped than formerly. At the same time, the foreign ordinary commercial joist delivered into this country, from Belgium in particular, is not a good joist, and frequently in some foreign joists the web is thickened to obtain the weight at the expense of a minimum flange. It must be remembered that wrought-iron does not flow like cast-iron, and it is difficult to get the material pushed up in rolls where the flanges are wide compared with the depth of joists. Iron joists are generally of greater sectional area than steel. They are the same depth and width, but weigh more per foot run on account of sectional area. Thus iron joists weighing respectively 56, 35, and 13 lbs. for 12 in. by 6 in., 10 in. by 5 in., 5 in. by 3 in. weigh in steel 44.30 and 11 lbs. per foot run.

Railway companies, for patriotic reasons, and more particularly for the benefit of their traders, usually insert a clause in their contracts that all materials provided by a contractor are to be obtained from traders who give their traffic to the company, and conveyed over the railways and canals (if any) belonging to the company. The manufacture depends mainly on the specification, and therefore both British and foreign steel may or may not be good, as the material known as mild steel may have almost any strength between that of hard steel and that of wrought iron.

The committee on the use of steel in railway structures appointed by the Board of Trade to consider the practicability of assigning a safe co-efficient, reported in 1877 that the steel employed should be cast steel, or steel made by some process of fusion, subsequently rolled or hammered, and that it should be of a quality possessing considerable toughness and ductility, and that a certificate to the effect that the steel is of this description and quality should be

forwarded to the Board of Trade by the engineer responsible for the structure. Also that the greatest load which can be brought upon the bridge or structure, added to the weight of the superstructure, should not produce a greater strain in any part than 6½ tons per square inch.

As in the use of mild steel, the extension per ton per square inch is practically equal to the compression, it follows that the neutral axis of a section of steel strained transversely will be in the centre of gravity of its section; but as in wrought and in cast-iron sections the unit stresses, particularly in the latter, vary in the case of tension and compression, diagram F illustrates how the moment of inertia may be calculated from a neutral axis not coincident with the centre of gravity.

The qualities required in a steel or iron structure being chiefly of a mechanical nature, it is reasonable that the test should be mechanical, and, provided these tests are satisfied, the designer does not trouble himself about the chemical constituents. Tests are provided to detect brittleness and to secure toughness, combined with ductility, malleability, and the result of experiments show that the tensile resistance and limit of elasticity are the main objects of inquiry.

Tensile strength 27 tons to 31 tons per square inch ultimate with elongation of 20 per cent. in 8 in. lengthways and crossways of the same.

Some excellent results of tests for malleability are shown in the diagrams, figs. 8, 9, 10, and 11, which were made on steel supplied by Messrs. Drew-Bear, Perks, & Co.

Specification for mild steel plates and sheets as adopted by the Great Western Railway Company:—

1. All plates to be of British manufacfure.

2. All plates and sheets to be of the exact dimensions ordered, and to be uniformly throughout of the thickness specified.

3. All plates and sheets to be flat and free from blisters, scale, laminations, buckles, and all other defects.

4. All plates and sheets to be of such quality as to weld perfectly.

Strips cut lengthwise and crosswise to be capable of standing the following tests:—

Tensile Test.—Ultimate tensile strength to be not less than 24 tons nor more than 28 tons per square inch, with an elongation of at least 22 per cent. when the thickness of the sample is more than $\frac{5}{16}$ of an inch, and with an elongation of at least 20 per cent. when the thickness is $\frac{5}{16}$ or less; elongation in each case to be measured over a length of 10 in.

Temper Bending Test.—Strips 1½ in. wide, heated uniformly to a low cherry red and cooled in water of a temperature of about 80 deg. Fahrenheit, to stand bending in a press to a curve the inner radius of which is equal to the thickness of the plate.

Cold Bending Test.—Strips 1½ in. wide to stand bending cold in a press to a curve the inner radius of which is equal to the thickness of the plate.

Punching Test.—The material to be tested for ductility by punching cold a group of holes ¾ in. to ⅞ in. diameter, the edges of which shall not be more than $\frac{1}{16}$ in. apart.

All mild steel rivet, channel, angle, T, and other bars to be of such quality as to weld perfectly, and to have an ultimate tensile strength of not less than twenty-four tons, nor more than twenty-eight tons per square inch, with an elongation of at least 25 per cent., measured over a length of 10 in.

All rivet bars to be rolled exactly round to gauges to be supplied by the railway company.

The material to be tested for ductility by being bent cold under a steam hammer; also by punching cold a group of holes ¾ in. to ⅞ in. diameter, the edges of which shall not be more than $\frac{1}{16}$ in. apart.

Rivet bars, in addition to the tensile tests, must stand bending double, both hot and cold. The head heated to redness must stand flattening until its diameter is three times the diameter of the bar without cracking at the edge.

All wrought-iron plates, sheets, and bars to be of British manufacture, tough, fibrous, and of the highest smithing quality.

All plates, sheets, and bars to be of the exact dimensions ordered, and to be uniformly throughout of the thickness or section specified.

All plates, sheets, and bars to be free from blisters, scales, laminations, buckles, twists, and all other defects. All plates and sheets to be flat.

All plates, sheets, and bars to be of such quality as to have an ultimate tensile strength of:—

	Tons per sq. in.	Elongation.
Round and square bars and flat bars less than 6 in. wide	23	with 20 p.c. in 10 in.
Angle, tee, channel, and H bars, and flat bars over 6 in. wide	22	with 12 p.c. in 10 in.
Plates with the fibre	22	with 10 p.c. in 10 in.
Do. across the fibre	18	with 3 p.c. in 10 in.

and to admit of bending round a radius equal to the thickness when hot through an angle of 125 deg. with the grain, and 100 deg. across the grain, and when cold as follows:—

Thickness of plates ..... in.	1 and ⅞	¾ and ⅝	½	7/16	⅜	5/16	¼	7/32	⅛	5/32	1/16
With the grain, through an angle of ..deg.	13	20	37½	25	27½	30	35	42½	50	60	70	75	85	95
Across the grain, through an angle of..deg.	5	7½	10	10	12½	12½	15	17½	20	25	30	30	40	50

The whole of the iron to be inspected and tested before leaving the manufacturers' works.

The Carnegie Steel Company, of America, specify for structural steel an ultimate strength of 60,000 to 70,000 lbs. (26·78 to 31·24 tons) per square inch.

Elastic limit, not less than one-half the ultimate strength. Elongation, 22 per cent.

Bending test, 180 deg. to a diameter equal to thickness of piece tested without fracture on outside of bent portion. The elongation shall be measured on an original length of 8 in., except when the thickness of the finished material is $\frac{5}{16}$ in. or less, in which case the elongation shall be measured in a length equal to sixteen times the thickness; and except in rounds of ¾-in. or less diameter, in which case the elongation shall be measured in a length equal to eight times the diameter of section tested.

The London and North-Western Railway Company specify that all steel shall be of British manufacture, produced by the Siemens-Martin open-hearth process, and of such quality as to withstand the following tests:—

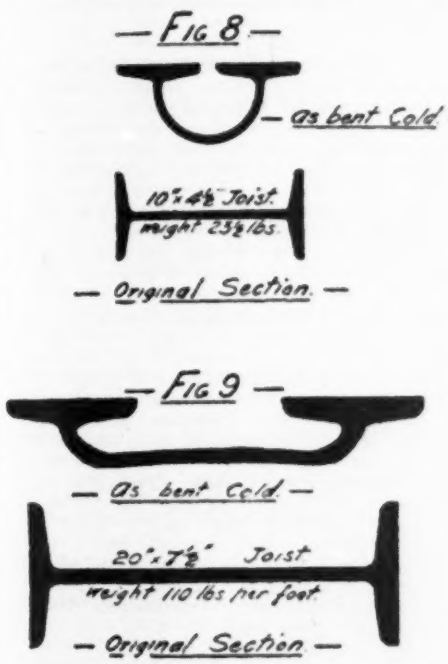
Ultimate tensile strain not less than 28 tons per square inch, contraction of area at fracture for same not less than 40 per cent., extension in a length of 10 in. not less than 20 per cent.

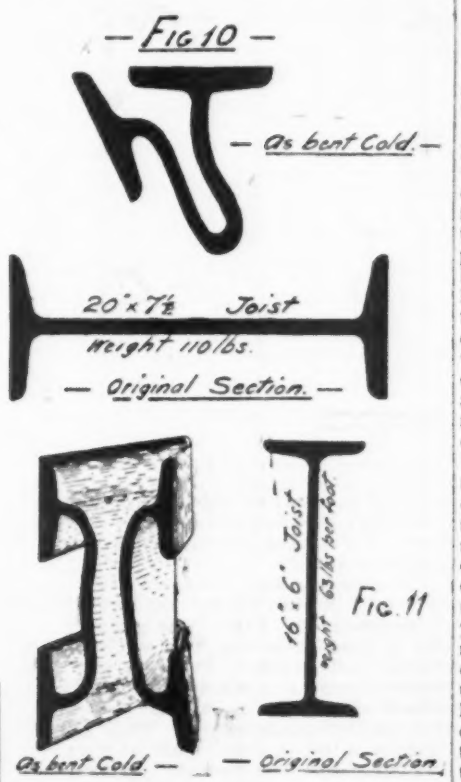
Some authorities prefer to take the elastic limit rather than the ultimate strength of the material, but as they then employ a proportionately smaller factor of safety, the result is practically the same.

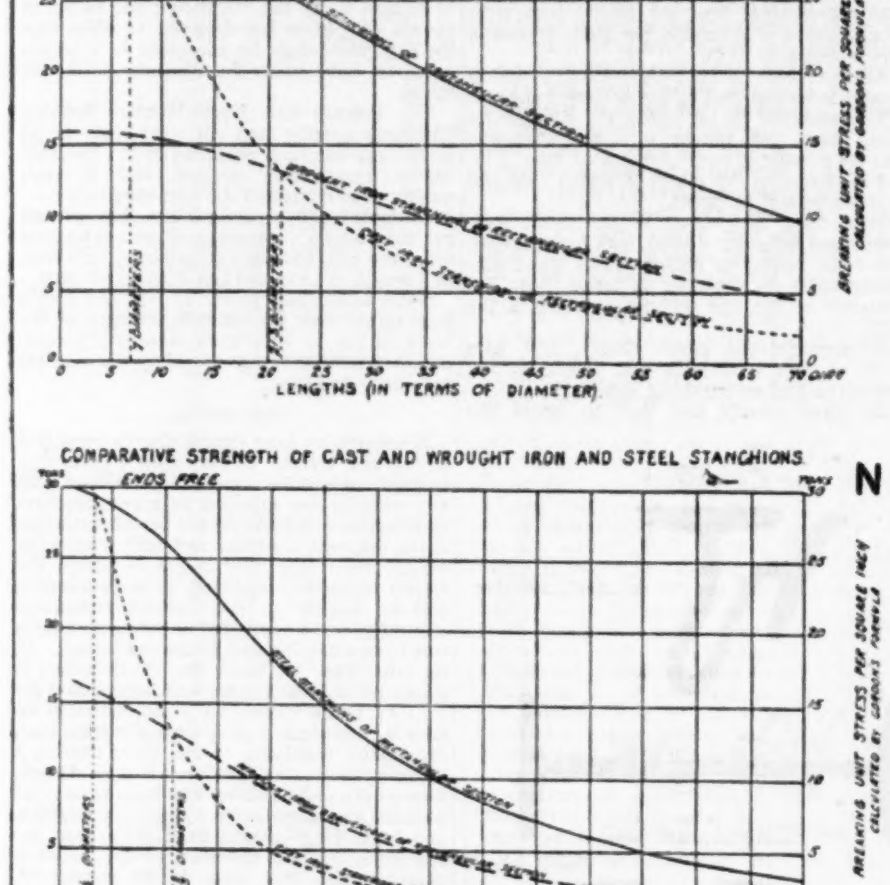
STANCHIONS.

It requires no long description to prove that a long and slender column always gives way by bending, but the reasons are not clear until we consider the question in a negative form and inquire why it should not bend? Referring to the diagram, a slender rod with rounded or hinged ends will bend like a bow, and the lateral resistances opposed to such bending will be similar to the vertical resistances offered by a rod supported at both ends over a free span when laid as a beam and loaded. In the latter case we know that the deflection is proportional to the amount and disposition of the load, so that to produce a great deflection we have to introduce a proportionally great load, the elastic resistance of the beam bearing a definite ratio to its deflection. In a solid block, viewed as a short column free from flexure, the element of compressive stress only prevails, and in a long column fixed at the ends, the reasoning is again modified by the points of contra-flexure that have to be considered. In every material the strength diminishes rapidly as we advance from short to long columns, but the reduction is more conspicuous in the cast-iron and the strong steel than in the softer metals. An inspection of the stress diagrams M N shows that in the case of free ends cast-iron is only economical up to 3½ diameters and for ends fixed up to 7 diameters, while for heights exceeding this ratio mild steel is preferable to the use of either cast or wrought-iron. This diagram is based upon calculations given in the formulæ tabulated below. In further considering the question of flexure in an upright column, there being no apparent transverse force to produce the bending, the result can only be caused by the ends tending to approach one another, and the condition of things resembles the action of a bow in which the ends are united by a member in tension, so that if we can determine the tension produced in the member uniting the ends, we shall have found the resistance that the bent column opposes to the load on its head. This evidently must depend more upon the elastic stiffness of the material and the dimensions of the columns than upon the crushing strength of the material. The form of the section is important, and a rolled joist section is preferable to the channel [or [] section sometimes employed with its web or back placed against a wall, because the compressive stress is more equally distributed over its section. An open or [ ] section also has this advantage for use as a stanchion compared, with a round, hollow column, that the whole surface can be seen and its thickness checked without the need of drilled holes to prove that the thickness is uniform.

A slender column is naturally a very weak one, and in order to obtain a satisfactory adoption of its introduction in a structure we must provide against the action of flexure, which is the source of its weakness. This may be


— Fig 8 —
— As bent Cold —
10" x 4½" Joist.
Weight 25½ lbs.
— Original Section. —
— Fig 9 —
— As bent Cold —
20" x 7½" Joist
Weight 110 lbs per foot
— Original Section —




COMPARATIVE STRENGTH OF CAST AND WROUGHT IRON AND STEEL STANCHIONS.
M
ENDS FIXED
LENGTHS (IN TERMS OF DIAMETER).
BREAKING UNIT STRESS PER SQUARE INCH CALCULATED BY GORDON'S FORMULÆ
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effected by the same means as in a girder, namely, by removing the metal from the centre and placing it as far away from the axis of the stanchion as possible. An inspection of diagram B shows at once the value of the development of material in a girder, and the same argument avails in a stanchion, so that by the adoption of four separate legs braced together like a lattice-girder we may so develop the material in a filamentary form as to considerably increase its efficiency. In a stanchion of any section the resilient force R is proportional to the modulus of elasticity, but is independent of the ultimate strength of the material. Thus a long stanchion of the strongest steel would vary little from a similar stanchion of wrought iron, because the modulus of elasticity is nearly the same in both these materials. However great the ultimate resistance of the steel may be, the crushing stress will inevitably be reached at some period of the increasing bending strain if only the load is sufficient to overcome the resilient force of the bow and to set up the ever-increasing deflection. When this deflection begins to act, the stanchion may be considered as having failed for all practical purposes, no matter what may afterwards happen to it during the course of the buckling process. A steel stanchion would theoretically take a greater ultimate deflection than the wrought-iron stanchion before it became actually crushed or crippled on the concave side, but the breaking weight would be nearly the same for both materials. When struts of different sections are ranged together according to the radius of gyration, the results of experiments agree together as closely as could be expected; but if struts of equal diameter and of different patterns of cross section are ranged together, their strengths vary. In short stanchions the superior strength of the steel will come into play, and in a stanchion of unequal elasticity it will come into play to some extent at all ratios of length to diameter.

Professor T. Claxton Fidler, in his treatise on "Bridge Construction," states that there can be no doubt that amongst the different sections of rolled iron bars or *built struts* the radius of gyration should be taken rather than the outside diameter as the true measure of stiffness.

In the author's diagram shown to represent the breaking weight of stanchions of different proportions, the *verticals* give the breaking weight in tons per square inch of sectional area, while the *horizontals* represent the ratio of length to diameter.

I=moment of inertia=sectional area of beam or stanchion × the square of the radius of gyration $(r)^2$.

Therefore, dividing the force R by the sectional area in square inches, we have the resilient force in pounds per square inch of the section of the strut expressed by—

$$f = \frac{R}{A} = \pi^2 E \frac{r^2}{l^2},$$

and this denotes the theoretical breaking weight of long stanchions in pounds per square inch, or the load which is sufficient to overcome the resilience (or the act of springing back, popularly known as "rebounding") of the bow, and to produce indefinite deflection.

Stanchions.	Ends Fixed.	Ends Free.
Cast-iron (solid) rectangular	$P = \frac{35}{1 + (\cdot0037)\,H^2}$	$P = \frac{35}{1 + (\cdot0148)\,H^2}$
Wrought-iron (solid) rectangular	$P = \frac{16}{1 + (\cdot0005)\,H^2}$	$P = \frac{16}{1 + (\cdot002)\,H^2}$
Wrought-iron (solid) angle	$P = \frac{19}{1 + (\cdot0011)\,H^2}$	$P = \frac{19}{1 + (\cdot0044)\,H^2}$
Mild steel (solid) round	$P = \frac{30}{1 + \left(\frac{1}{1400}\right)H^2}$	$P = \frac{30}{1 + \left(\frac{1}{350}\right)H^2}$
Mild steel (solid) rectangular	$P = \frac{30}{1 + \frac{1}{2480}H^2}$	$P = \frac{30}{1 + \left(\frac{1}{620}\right)H^2}$

NOTE:—P = Crippling stress per square inch in tons. $H = \frac{L}{D}$ = ratio of length to width in direction of plane of flexure. P × area = breaking stress of given section.

The Chairman said they had listened to Mr. Walmisley's paper with the greatest interest. Two years ago Mr. Walmisley read a most valuable paper before them on "Foundations,"* and the paper he had just read was equally valuable and scientific. As they had a large number of their engineering friends present that evening, he hoped they would have a good discussion on the paper.

Professor Hy. Adams said he had much pleasure in proposing a vote of thanks to Mr. Walmisley for his interesting and valuable paper. He felt they would agree with him in saying that a paper or lecture from Mr. Walmisley was sure to be sound, reliable, and complete. The subject was one of considerable interest to constructional engineers and architects. The diagrams which the lecturer exhibited were also of great assistance and he hoped that they would be illustrated when the lecture was printed. Many interesting points had been dealt with, but perhaps the most important was that of the safe loads given in the makers' lists. He had just had occasion to refer to some of those lists, and he was surprised to find so many extreme statements. For instance, three different lists gave joists 12 × 5 × 39—39 lbs. as being suitable for spans of from 30-32 ft., and capable of carrying loads of 7 to 9·4 tons. Mr. Walmisley suggested that the span should be twelve times the depth, but that would hardly be suitable for architects, and, as a matter of fact, they made a span in feet equal to twice the depth in inches, though even that did not satisfy some designers, for in a fireproof floor made of iron and concrete there was a still greater ratio of span to depth. The 12 × 5 × 39 lbs. was in one list limited to a 20-ft. span, and a safe load was given as 15, 11, and 9 tons, according to the factor of safety adopted. He had had the curiosity to work out what the result would be of loading the 12 × 5 joists with the suggested load of 9·4 tons on a 30-ft. span. It would give a deflection of 2 in., the ordinary deflection being $\frac{1}{16}$ per foot of span, and the load that would produce that would be 3 tons, and with the great span of 30 ft., and a shallow depth of 1 ft., the engineer in the ordinary way would think that sufficient load to put on it.

Mr. Percival Marshall, President of the Institution of Junior Engineers, seconded the vote of thanks, and on behalf of his society expressed the thanks of the Institution to the Architectural Association for the courtesy which had enabled so many members of the Institution to hear such an excellent paper. The subject was equally interesting to both engineers and architects, and it seemed a very desirable thing that members of both professions should have

* See our issue for May 28, 1898.

Example—Steel Stanchion.—Joist 12 in. by 6 in., weighing 62·5 lbs. per foot.

Length in feet.	Weight per foot run. lbs.	Ratio $\frac{L}{B}$	Calculated Breaking Limit. Stress in tons.	Area for Flanges. Square in.	Breaking Weight (ends free).	Ratio $\frac{L}{T}$	Calculated Breaking Limit. Stress in tons.	Area for Web.	Breaking Weight (ends free).	Total Breaking Weight in tons.
14	62·5	28	13·30 See formula.	12·48	165·98	247	·30 See formula.	6·12	1·83	167·81

an opportunity of discussing that and similar subjects together. There were certain matters which might very well be discussed by the two professions, such, for instance, as the standardisation of sections, for he thought that if makers would fall into a uniform practice in producing their sections it would facilitate the work of architects in designing structures.

Mr. B. Blount (Messrs. Stanger & Blount, of Westminster) said he had listened with considerable interest to the paper—not only to the mechanical side of it, which appealed particularly to members of both professions, but also to the chemical side, which appealed to him very closely. There was ample scope for debate in the chemical side of the subject. They had heard of the influence of the various non-metals which were present in mild steel on its tensile strength, and ultimately on its strength when put into a structure. This influence was enormous, and had been recognised for some time by engineers, in structures which had to carry dynamic loads, such as rails. The subject of rails had come into prominence lately, owing to certain disastrous failures and the concensus of opinion drawn from experiments based on these failures was that caution should be exercised in increasing the tensile strength of our mild steel. Naturally he agreed with that, and yet he felt that safety could be secured at too great a cost; one should proceed cautiously, but should at all events make progress. In connexion with that he might refer to a point touched upon by Mr. Walmisley, viz., the American practice of increasing certain non-metals in steel. That was thoroughly to be condemned. Mr. Walmisley had stated with accuracy that a high proportion of phosphorus was to be found in steel which American firms were offering to English consumers. The percentage given was, however, somewhat lower than the average, which was more like 0·10 per cent. than 0·08 per cent. The English steel maker, although protected by certain railway companies as mentioned by Mr. Walmisley, was nevertheless handicapped by competition of that kind. The American product was not, as a rule, as good as the English. As to the ultimate composition of steel which influenced its quality, one might have two steels which were chemically identical but differed in their micro-structure. Already in his own practice he had found much advantage from the microscopical examination of steels, especially in those cases where fracture was caused by influences which seemed to be obscure. Architects and engineers who were, as all members of those professions must be, at times troubled by failures not readily explicable should remember that a mere specification of the mechanical properties of steel and even its chemical composition, was not everything; they must also take note of the microscopical character of the metal.

Mr. R. J. Gifford Read said that not only was the paper very valuable, but the diagrams and formulæ also. Very many of the tables prepared by Mr. Walmisley were worthy of study, since they would afford a ready means of obtaining the necessary strength and values of the various sections when one was engaged in designing a structure. The use of rolled joists in construction was a very important matter in the erection of buildings. Nowadays buildings in towns were required to give far more accommodation than formerly, and sites for buildings were, as far as his experience went, very often curtailed, and seldom was a constructor left free to erect the best form of building possible. In these circumstances the advent of rolled joists had been a great boon to the architect and constructor, because joists gave an opportunity of carrying over spaces, walls, floors, and suchlike, larger, more numerous, and heavier than was possible in the days of wooden beams, while the modern iron joists occupied far less space. But while there were good reasons why rolled joists had become essential in modern buildings, he had never heard an architect say that he liked them—though for that matter architects did not appear to care for engineering work at all. Still, rolled joists were absolutely necessary nowadays, and if properly used they did excellent service. The value of a rolled joist was greatest when it could be placed directly across a span from wall to wall, but if rolled joists had to be used in a complex way, as they often were—one trimming into another, or two or three trimming into each other, and having bends and awkward connexions—it was very difficult to make thoroughly good joints, and that was one of the most essential points with regard to rolled joist work. The joists were not so pliable and easily handled as the angle iron and plate work such as Mr. Walmisley had referred to in the roof of the Olympia, and in regard to that roof, he looked upon it as one of the finest roofs, if not the finest, in England. The connexions were a very important matter, and he would especially draw their attention to the connexions shown in diagram H. That, of course, showed the right way of making connexions, but he was afraid they were never done like that, for generally the joists were wanted as soon as they were ordered, and they had to be fitted as quickly as possible, and the common way of treating them was to notch down the flange and trim it in with an angle iron to the other joist. Of course, it should be rounded off in the careful way shown in the diagram, but generally that was a practical impossibility. There were many points connected with joists that theoretically should be done, but which practically it was difficult to get done. In diagram E Mr. Walmisley very properly showed the advantage of having two joists side by side, with plates to carry a wall. The diagram showed a very good section, but if the joists were further separated and the flange plates made twice the width, but half the thickness, they would not get as good a girder. A necessary point to consider was the proper proportions of the widths of the joists to their depths, and the thickness of the plate so as to get a girder which would do the work and have the greatest strength for the amount of iron used. With regard to the varying strength of joists, whether rectangular or of other section, the moment of inertia could be determined mathematically, having reference to the area only; but another matter had to be considered, viz., the quality of the material, and it was found that the breaking strength of the thick sections worked out greater than the strength given by a formula deduced from the moment of inertia. In fact, he believed it had been found that the breaking strength was 70 per cent. greater than the theoretical strength for a rectangular section.

Mr. P. J. Waldram said he felt that any one who had not dealt in mathematical formulæ might think that the paper was too scientific to grasp, but really the subject was not so complicated as some might think. There was one little practical point he might venture to warn architects as to—viz., that in specifying for rivetted-up work they should be careful to ascertain the market price. It was sometimes more expensive to put less material in the joists than more of a certain character, and it was well in extensive work to get a proper estimate before deciding on rivetted-up work. As to rivetted-up work, in order to develop the full strength of the plates the rivets should be designed and not guessed at. He would like to give expression to a warning as to piers. Piers should be piers in the true sense of the word, and their height must be taken into consideration. A terrible illustration as to that was, he believed, afforded in the Abbey Mansions disaster. Piers were not piers when they started at the base and went up to the top 18 in. wide. In going into the question of strength or otherwise it was easy to forget, in looking at a pier 2 ft. square on any floor, that it went down to the basement.

Messrs. H. Lovegrove, W. H. Shephard, and H. Satchell having briefly spoken,

Mr. H. Young, junior, said of course the steel joist was not a very pretty thing to look at, but it was a most effective section, and it was the outcome of years of thought by theoretical and practical men. From theoretical and empirical formulæ had been produced the most efficient section it was possible to have, and all that remained was for the manufacturer to make a steel which would be homogeneous and of better quality. Steel joists had grown from cast iron to wrought iron and then to steel. Could Mr. Walmisley tell them anything about the Talbot process of making steel? It did not do to accept manufacturers' figures without investigation. In selecting a joist from a merchaht's list, the first thing to know was what it was to do; if to support a brick wall, a little settlement of that wall did not much matter; but if it had to support a cast-iron tank, with caulked joints, any deflection of the joist would be a serious matter. It was true that the designer could not always get what he wanted, owing to the inundation of work at the mills; but the best way out of that difficulty was, if it could be arranged, to order the joists some considerable time before they were wanted. As to the question of steel stanchions *v.* cast stanchions, if they wanted a stanchion to carry from 50 to 500 tons, the best thing, he thought, was to have the cheapest, and up to a certain point the cast-iron stanchion was by far the cheaper. At the Paris Exhibition he had expected to see a great many steel joists, but he did not see any. He did not know whether that was because the French liked something more graceful and æsthetic than the joist, but at all events they used extensively a small lattice girder coloured in light blue with the rivets picked out in gold. Whatever the French touched looked well. The Alexandre III. bridge across the Seine was an example of a cast-steel joist: it was one arch thrown across in the section of a joist made of cast steel, and he thought they would all agree that it was one of the finest bridges thrown across the river of one of the finest cities in the world.

The Chairman said he would like to reciprocate on behalf of the Association what the President of the Junior Engineers had said. As an Association they were glad to welcome their engineering friends, and he felt that they had gained largely by the liberal way the engineers had entered into the discussion, and he hoped it would be possible to arrange similar meetings in the future. Architects who listened to such a highly scientific paper felt that it was impossible to compete with engineers in applied science, and in discussions such as they had heard that evening the members of the Association could not fail to profit. He felt that every year, perhaps, the two professions got a little wider apart, as science and investigation became more elaborate, and engineers, for instance, went ahead in matters scientific and architects devoted their time and power more and more to what they considered their proper province, viz., the art side of their work. He thought that must be the tendency of specialism, which in itself was inevitable as information became more extended. The last speaker made allusion to the beautifying of those more scientific constructions, and, for his part, he had often felt how true was the praise of another gentleman as to the roof of Olympia. That roof had often given him pleasure to look at, and he thought it was another illustration of the fact that where science was rightly applied there was no reason why it should not be beautiful. Most of them knew how beautiful the French could make their engineering and other structures, and many illustrations could be drawn from the Continent of simple, beautiful structures in iron and steel. England was far behind in applying art to scientific construction, and he felt that members of the architectural profession should bear that in mind.

The vote of thanks was then put to the meeting and very heartily agreed to.

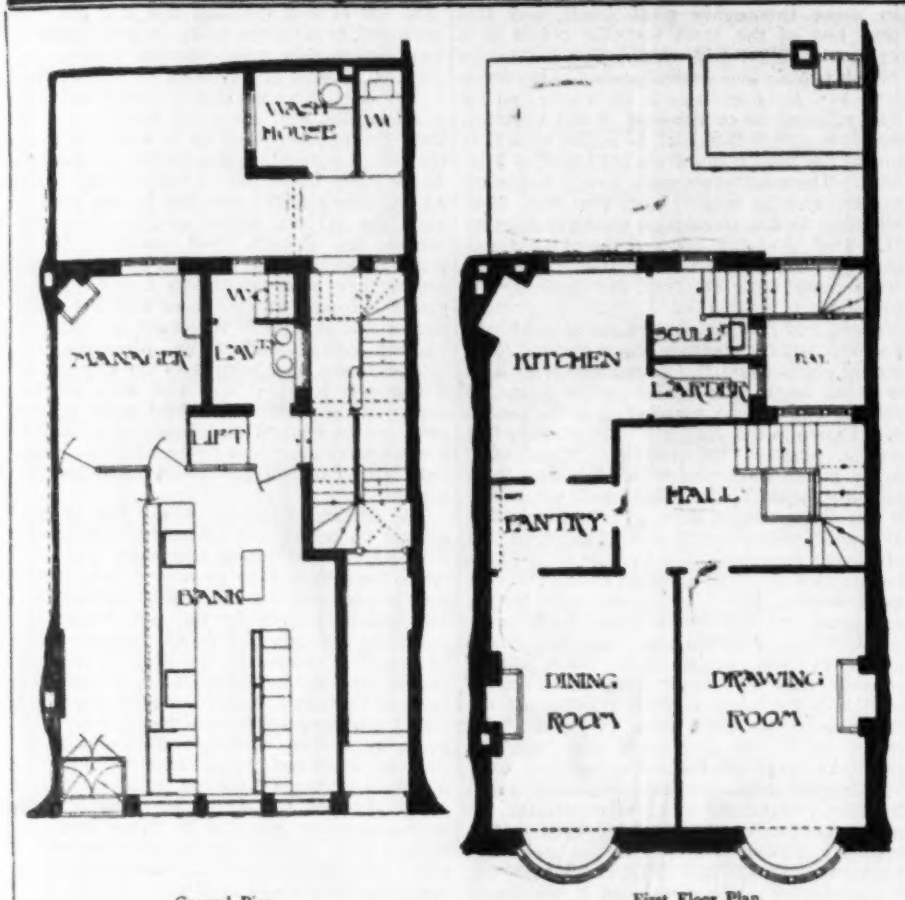
Mr. A. T. Walmisley in reply said it never did to have a cast-iron beam fixed at both ends, because it was not made to take tension and compression in the same flange. Engineers, although they recognised some advantage in a stanchion or girder fixed at both ends, preferred, where possible, to have a girder or stanchion free at both ends because the stresses were then more definite. As to the roof of Olympia, he ought to say that although he had a great deal to do with that building, for certain reasons—partly on account of the extent of the work, and partly because of the way the money was found—another engineer was associated with him. In that roof the whole structure was so developed that the only continuous plates were cover plates.

The meeting then terminated.

The next meeting will be held on December 7, when Mr. Wallace Rimington will read a paper on "Colour in Architecture seen through an Artist's Glasses."

BUILDERS' CLERKS' BENEVOLENT INSTITUTION.—At a special general meeting of this Institution held at the offices on the 27th ult., there was an election for two pensioners. There were three candidates, and Mrs. Redfern and Mrs. A. M. Smith were elected to the widow's pension of 24*l.* per annum. This is the second election held since Midsummer last. In the unavoidable absence of the President Mr. O. Newling was voted to the chair.

RESTORATION OF BLACKMORE CHURCH, ESSEX.—Part of the north wall of this church is being rebuilt, and the steeple, of wood, is being restored. Mr. Chancellor is the architect, and Messrs. Brown & Son, of Braintree, are the contractors.



Ground Plan. First Floor Plan.

Martin's Bank, Bromley. Plans.

Illustrations.

A FRIEZE OF THE ATTIC MONTHS.

IN this, the attempt has been made to seize the more prominent and simple suggestions offered by the names of the Athenian months, and, as far as might be, to present a central typical subject for each, round which the imagination may group the manifold accessories and conjectures which belong to them, and which cannot be expressed here.

The composition commences at the left hand of the upper length shown in the illustration, and is continued from left to right on the lower length.

The first month, Ilecatombæon, has a bull dedicated to sacrifice, the typical offering of the great sacrifices, whence the name of the month.

The second, Metageitnion ; the changing of neighbours by change of domicile. This is a group of a man and his wife, with their child and household god, migrating from one suburb of Athens to another.

The third, Boedromion. Apollo runs to scare the horse of the Amazon queen in response to the prayer and sacrifice of Theseus, to whom victory is thus granted.

The fourth, Pyanepsion. A household which has prepared the dish of beans or of peeled barley in honour of Apollo is greeted by the youth, the elder son, as he advances bearing a branch of olive. This he will carry in procession and place as he is bid, before the threshold of the dwelling, or perhaps near the shrine of the god himself.

The fifth, Maimacterion. The month of Zeus, the boisterous, who half starts from his throne to speed the Genius of blast and torrent on his course.

The sixth, Poseideon. Here Venus, whom Poseidon, ruler of the ocean, accosts, partly disrobes, to plunge into the waves.

The seventh, Gamelion. The month, favoured for weddings, is represented by a group where a bridegroom leads home his bride, attended by his friend, or best man. At the threshold stands the mother with a pine torch to welcome them to the nuptial abode.

The eighth, Anthesterion. The month of the flower feast is expressed by the four figures next grouped, who together suggest some of the characteristics of the three days of the great Festival of Dionysius now held. The opening of the wine cask, or jar, whence one youth has filled a cup for the second youth, who holds it ready to give to a third. This third lad is just ceasing his dance or hop upon the greasy goat's skin. Beyond them a maiden stands with basket and wreath of flowers, and beside her is placed an earthen dish of meats for consumption at the holiday feast.

The ninth, Elaphebolion, the hunting and slaying of the deer by Artemis.

The tenth, Munychion. To three sea-farers, Artemis, as "the Lady Munychia, watching over harbours," appears propitious.

The eleventh, Thargelion. A festival in honour of Apollo and Artemis was held in this month ; and the sacred embassy to Delos, some time in the ancient vessel of Theseus himself, took place. In allusion more especially to the latter celebration, Apollo here manifests himself with certain of the accessories of his Delian aspect—the bow, the group of the Charites or Graces, &c.—but devoid of the archaic severity of his conventional sculptured image, to three devout youths, musicians, who have hymned his praises.

The twelfth, Scirophorion, is expressed by the sciron or white parasol borne by the priestesses in the procession of the festival of Athena Sciras. J. S. B.

MARTIN'S BANK, BROMLEY, KENT.

THIS bank and the adjoining premises were built in 1898 by Mr. Duthoit, of Westmoreland-road, Bromley.

The lower part is of unpolished granite, the upper part of red brick; the space between the bays is covered with enriched and partly painted and gilded cast lead ; the gutters are also of cast lead, the work of Messrs. Wenham & Waters, of Croydon. The bank windows are made of gun metal, the doors, &c., of unpolished teak.

The internal fittings were made by Messrs. Sage & Co., the heating is by Messrs. Longden, and the strongroom work by Messrs. Chubb.

Mr. Ernest Newton is the architect. The drawing was exhibited at the last Royal Academy.

WAREHOUSES, BERLIN.

THIS represents a block of warehouses erected in Berlin from the designs of Herr Otto March, architect. They form an example of modern German street architecture of this class.

The architect, it will be seen, in spite of having to provide for a great deal of window space, has contrived to preserve solid and substantial piers to the building.

THE SURVEYORS' INSTITUTION:

ROOFS OF FARM BUILDINGS.

AN ordinary fortnightly meeting of this Institution was held on Monday evening at No. 12, Great George-street, Westminster, Mr. John Shaw, President, in the chair.

The minutes of last meeting having been read and confirmed, Mr. J. W. Penfold, hon. secretary, announced that Mr. John Farrer, of Oulton, near Leeds, had been elected as a member of Council. He also announced that Mr. John Wright Kirk, of Westminster, had been transferred from the class of Professional Associate to that of Fellow.

Some donations to the library and library fund having been announced, and a vote of thanks accorded to the donors,

A paper by Mr. A. T. Walmisley, on "Roofs of Farm Buildings," was read by Mr. Julian C. Rogers, secretary, at the request of the author, who was not feeling sufficiently well to read it himself, although he was present. The paper (which is unavoidably held over), together with the author's diagrams, and some notes of the discussion which followed, will be given in our next issue.

The next meeting of the Institution will be held on December 10, when Mr. R. E. Middleton will read a paper on "London Water Supply."

COMPETITIONS.

PUBLIC BATHS, KIDDERMINSTER.—In the limited competition for designs for public baths, Kidderminster, the first premium has been awarded by the Town Council to Messrs. Gething & Son, and the second to Messrs. Meredith & Pritchard.

ARCHITECTURAL SOCIETIES.

ARCHITECTURAL ASSOCIATION OF IRELAND.—An ordinary meeting of this Association was held in the Grosvenor Hotel, on Tuesday, the 20th ult., the President, Mr. F. Batchelor, in the chair. Mr. T. E. Hudman read a paper on "Georgian Architecture in Dublin," dealing chiefly with the period between 1714 and 1830. During the reign of the Georges the population of Dublin increased from 8,000 to 169,500, and thereby expanded from what was little better than a small mediæval town with narrow streets and a congested population into a metropolis with wide streets and many noble buildings, mainly due to the efforts of "The Wide Street Commission" appointed by Act of Parliament in 1757. Many of the oldest houses, now rapidly disappearing, were undoubtedly of Dutch origin, but the buildings of the later period, both public and private, such as the Custom House, Trinity College, the Bank of Ireland, the Four Courts, the City Hall, &c., designed by such master hands as Sir William Chambers, Gandon, and other eminent architects, were still in existence. The striking feature of Dublin was its wide line of streets and squares, and the effect of its public buildings, so judiciously placed—the line from College-green to Rutland-square would be hard to beat, not to mention Merrion-square, Fitzwilliam-square, and St. Stephen's-green, and the surrounding network of streets. The paper was illustrated by lantern slides, chiefly from photos taken by Mr. Hudman and Mr. Black.—The first of the series of technical demonstrations, mentioned in our "Note" last week, was held at the works of Messrs. H. & J. Martin, Grand Canal-street, Dublin, on the 23rd ult. There was a large attendance of members, numbering over forty. The lecturer, Mr. J. Martin, dealt first with various forms of damp courses, and then passed on to bricks, their qualities and durability. He showed many samples of stock bricks, coloured and glazed facing bricks, and fire bricks, most of which were of Irish manufacture. He next proceeded to show varieties of sand, fine and coarse, used in the quay walls by Dr. Stoney. After dealing with piling according to the method prevalent in Belfast and with other foundations, Mr. Martin explained the briquette test for cement, and many more ready tests. The demonstration lasted considerably over an hour, and that the scheme is appreciated in

ΕΚΑΤΟΜΒΑΙΩΝ ΜΕΤΑΓΕΙΤΝΙΩΝ ΒΟΗΔΡΟΜΙΩΝ
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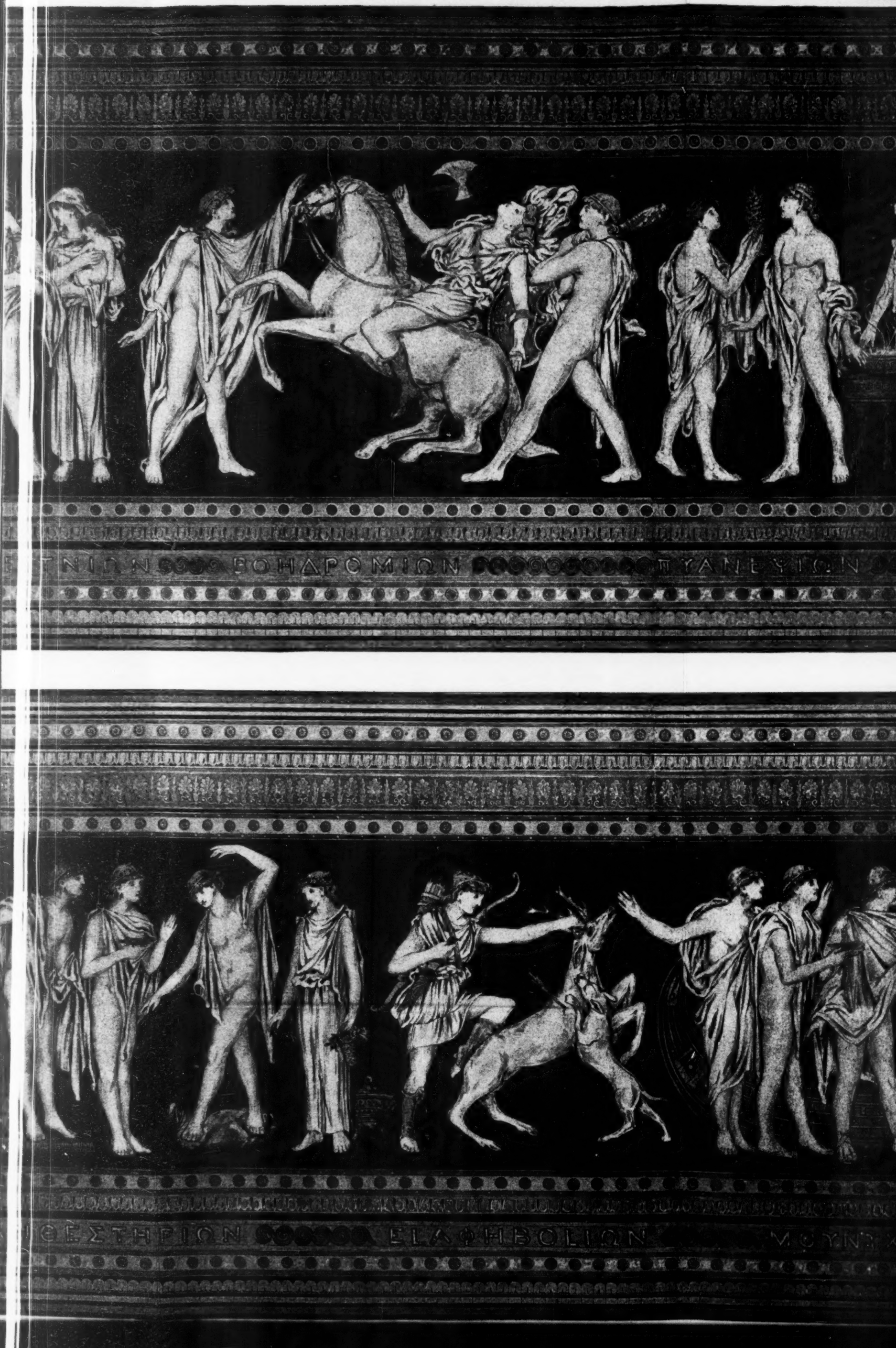
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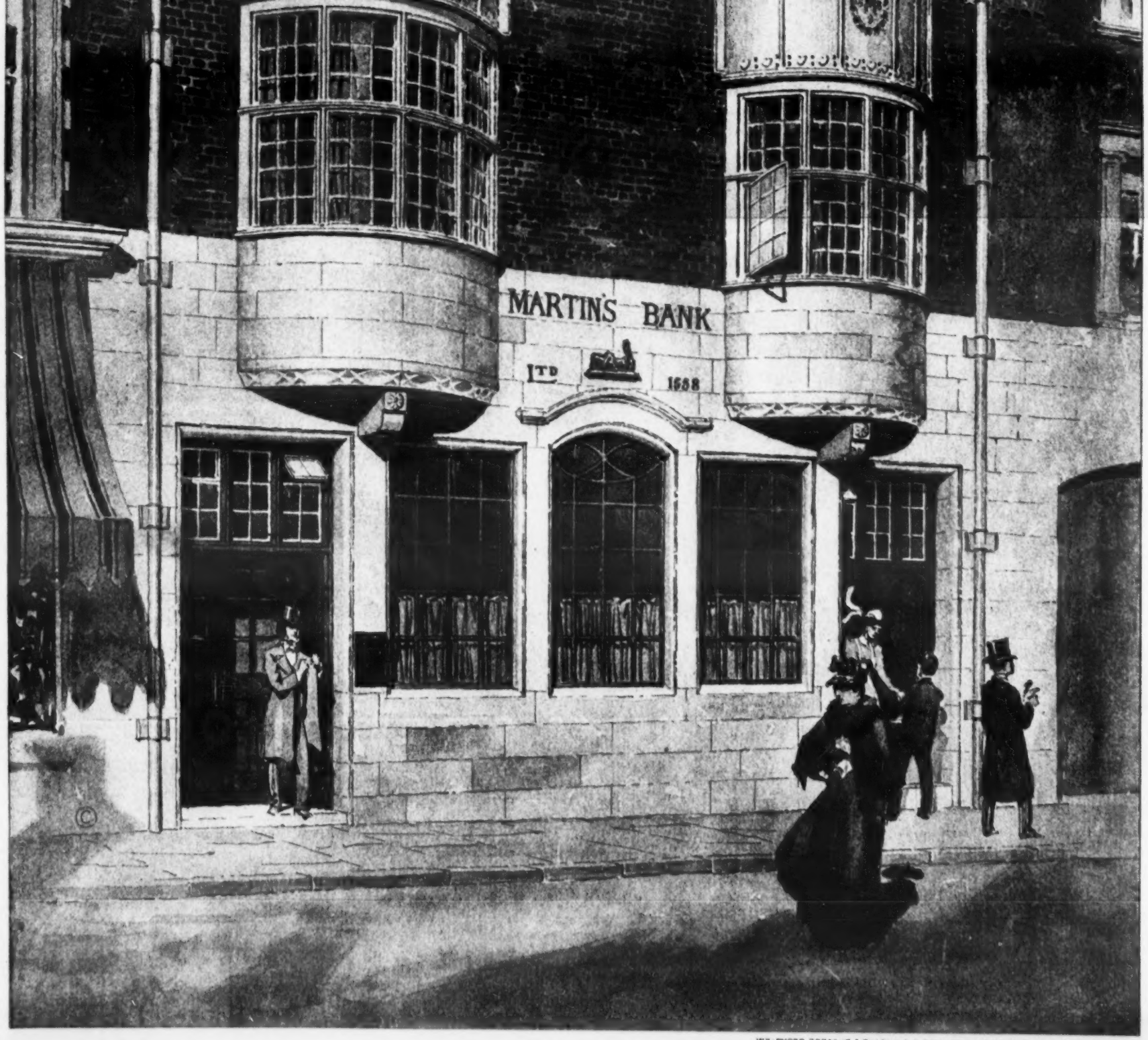


INK. PHOTO. SPRAGUE & Co LTD 4 & 5, EAST HARDING STREET, FETTER LANE, E.C.

MARTIN'S BANK, BROMLEY.—Mr. Ernest Newton, Architect

WAREHOUSES, BERLIN.—

PHOTO-LITHO. SPRAGUE & Co LTD 4 & 5 EAST HARDING STREET, FETTER LANE, E.C.

S, BERLIN.—HERR OTTO MARCH, ARCHITECT.

Dublin is evinced by the fact that many new members are joining the Association in order to avail themselves of its benefits.

ARCHÆOLOGICAL SOCIETIES.

BRITISH ARCHÆOLOGICAL ASSOCIATION—The second meeting of the session was held on November 21, Mr. C. H. Compton, V.P., in the chair. The Hon. Editorial Secretary, Rev. H. J. D. Astley, read an interesting *résumé* of the proceedings of the recent Congress at Leicester, which will be published in the *Journal* in due course. Mr. Astley also read "Notes on the Mound Dwellings of Auchingaich," by Mr. W. A. Donnelly. The locality of these mounds is in the north-west corner of Dumbartonshire, in that picturesque and mountainous belt which runs between Loch Lomond and the Gareloch on the Auchingaich, one of the highest tributaries of the Fruin Water. The mounds first attract attention from their colour, as well as from their configuration, the turf on their hillock surfaces being generally of a deeper green and their outlines suggesting a more monotonous repetition of contour than is found in any natural configuration of landscape. They are grouped together in clusters of three and four or half a dozen, almost touching one another—as a matter of fact, many do touch each other—they form a border to a quadrangular space about 100 yards square, and number over forty. The mounds are all more or less circular in shape, standing about 5 ft. high at the highest, but more often not more than 3 ft. 6 in. above the level of the natural hillside, and present a remarkable similarity to the homes of the beaver. Further off, on the right bank of the Auchingaich, Mr. Donnelly discovered another group about 100 yards up the mountain-side of some seventeen or twenty more similar mounds. Excavations were made in some of them which disclosed the existence of boulder-built walls, rude and strong, each mound having a narrow doorway with the jambs invariably in their original position, but the lintels displaced, and in two instances lying on the doorstep. The general characteristics of these mounds suggest the idea of their having been the homes of an early pigmy race. In the discussion following the paper, the Chairman, Mr. Rayson, Mr. Folkard, the Rev. H. J. D. Astley, and others took part. Various opinions were expressed as to the probable value of the discovery, but all were agreed in attributing the construction of the mounds to human hands, but by whom, for what purpose, and at what period they were constructed it is impossible to say with the data at present furnished. Further exploration, which will be undertaken in due course, may enable archæologists to arrive at a definite conclusion.

BUILDERS' BENEVOLENT INSTITUTION:

ANNUAL DINNER AND PRESENTATION.

THE fifty-third annual dinner of the Builders' Benevolent Institution was held on Thursday, November 22, in the hall of the Carpenters' Company, London Wall. Mr. John Greenwood, C.C. (President), occupied the chair, supported by Messrs. J. Howard Colls (Hon. Treasurer), T. F. Rider, E. B. Nightingale, A. Lucas, A. E. Parker, H. H. Bartlett, A. Ritchie (J.P.), W. Higgs, Professor Roger Smith (Master of the Carpenters' Company), C. Bussell, Thomas Stirling, J. T. Bolding, and others, the company numbering altogether about 140.

The toasts of "The Queen" and "The Prince and Princess of Wales and the rest of the Royal Family" having been received with enthusiasm,

Mr. Arthur Lucas gave "The Army, Navy, and Auxiliary Forces," which was responded to by Major R. A. Brutton (Secretary) and Major W. J. Brown.

The President then proposed the toast of the evening, "Prosperity to the Builders' Benevolent Institution." He said that previous to the late municipal election a certain noble lord made some unsatisfactory remarks in reference to builders. In doing so, the noble lord could hardly have realised what an important trade the building trade was, and what an immense number were engaged in it. It was a most difficult business to carry on, for many a man had done his very best, working early and late, and yet from circumstances entirely beyond his control things had not turned out so well as he had anticipated. Such a man perhaps lost all he had, his health failed through worry and anxiety, and at last he found himself stranded. This Institution then came to his aid, after looking carefully into the circumstances of the case. The charity, he might add, was founded in 1847, since which time there had been 289 pensioners elected, the present number being forty-six. Of these the men received 39*l.* and the women 27*l.* a year. New annual subscribers were urgently needed to take the place of those who had been removed by death. The Institution depended entirely on the liberality of the members of the building trade, who might be sure that whatever they subscribed would be thankfully received and faithfully applied.

The toast was heartily received.

Mr. J. Howard Colls, who responded, said that for some time, it might be said, the building trade in London had been passing through fairly good times, but there were already indications that it was not going to be so good. It was, therefore, particularly advisable that builders should subscribe while they had good times. He had watched this Institution for many years, and he did not believe that any committee could give more attention to the claims that came before them.

Mr. A. E. Parker gave the toast of "The Worshipful Company of Carpenters," and referred to the great interest taken by them in all matters connected with the building trade.

Professor Roger Smith (the Master) replied, and expressed the pleasure of the Company in doing anything they could to assist this charity and the building trade.

Major Brutton (Secretary) then read the list of donations, which showed a grand total of 720*l.* Of this amount the President's list represented 574*l.*, his own subscription being 105*l.*

Mr. T. F. Rider gave the toast of "The President," which was cordially received.

Mr. A. Lucas next presented a testimonial to Major Brutton. This consisted of a cheque for 160*l.*, and the following testimonial:—"This testimonial was presented to Major R. A. Brutton, together with a cheque for 160*l.*, by upwards of 200 subscribers, in recognition of twenty-five years' faithful service as Secretary of the Builders' Benevolent Institution, and with many wishes for his future health and prosperity." Major Brutton, he added, had spent a quarter of a century of hard work in furthering the efforts of the charity. The Major was a kindly gentleman and an honourable man, who was ready and able to give advice because of his devotion to the cause he loved. Indeed, the success which has attended the Institution was due in no small measure to the devotion of their able Secretary.

Major Brutton replied, and returned thanks for the presentation. Though the cheque was most acceptable, there was something he valued far more, and that was that he had gained the esteem of so many gentlemen connected with the Institution, and that esteem would live for ever in his memory. He thanked the members of his Committee for many acts of kindness and he desired specially to mention the names of Mr. T. Stirling, Mr. J. T. Bolding, and Mr. C. Russell who had given him so much assistance.

Mr. H. H. Bartlett proposed "The Architects and Surveyors," to which Professor Roger Smith and Mr. H. Northcroft replied.

Mr. Alex. Ritchie, J.P., gave the last toast "The Vice-Presidents, Committee, and Stewards," for whom Mr. L. J. Maton and Mr. J. T. Bolding responded.

THE LONDON COUNTY COUNCIL.

THE usual weekly meeting of the London County Council was held on Tuesday in the County Hall, Spring-gardens, Alderman W. H. Dickinson, Chairman, presiding.

Loans.—On the recommendation of the Finance Committee it was agreed to lend the Shoreditch Borough Council 7,100*l.* for the erection of model dwellings; the Greenwich Guardians 150,000*l.* for the erection of a workhouse; the St. George's Union 22,900*l.* for the extension of the infirmary; the St. Giles-in-the-Fields and St. George, Bloomsbury, Guardians 12,910*l.* for the erection of receiving-house and nurses' home; and the St. Saviour's Union Guardians 20,500*l.* for the erection of additional buildings at Newington workhouse.

The Front of St. Martin's Church.—The Improvements Committee brought up the following report in regard to the front of St. Martin's Church:—

"We brought up to the Council on October 23, 1900, a report upon a letter which we had received from the Vestry of St. Martin-in-the-Fields submitting a proposal for the widening of St. Martin's-place by the alteration of the steps in front of St. Martin's Church, and asking the Council to contribute part of the cost of the work. We recommended the Council to contribute one-third of the net cost of the work, such contribution not to exceed the sum of 270*l.* The Council, however, after debate, referred the recommendation back to us with instructions to take expert opinion as to the architectural effect of the proposed alteration, and to request the Vestry of St. Martin-in-the-Fields meanwhile to take no further action for carrying out the work.

In compliance with these instructions we have taken the opinion of the Royal Institute of British Architects upon the proposal, and we requested the Vestry meanwhile to take no further action for carrying out the work. The Vestry informed us that they had already entered into a contract for the work, that a considerable quantity of stone had been obtained, that the work had been put in hand, and that experts were of opinion that the general architectural effect of the church would not be prejudicially affected by the proposed alteration. As soon as the Council of the City of Westminster superseded the Vestry, we asked them to arrange that no further action should be taken in the matter until we were in a position to come to a definite decision as to contributing towards the cost of the suggested work, with the result that the Westminster Council have agreed that the work shall not be proceeded with for another fortnight.

It will now be well if we give the details of the application made by the Local Authority. The steps of the church have undoubtedly been in a dilapidated condition for some time, and owing to their condition and position are the cause of frequent accidents to pedestrians. The Vestry in 1896 asked the Council to undertake as a county improvement the reconstruction of the steps in such a way as to secure a widening of St. Martin's-place. The Council on April 13, 1897, upon our recommendation, informed the Vestry that it was not prepared to carry out the work as a county improvement. We have given careful consideration to the proposals now put forward. At the present time a flight of steps leads from the portico of the church to a terrace or landing. This landing is about 9 ft. wide on the south side of the portico, and connects with the footway of Duncannon-street by another flight of steps. The landing on the west side of the portico is about 4 ft. 6 in. wide, and connects with the footway of St. Martin's-place by a flight of steps which gradually tapers away as the footway rises to the level of the landing at its northern end. The footway between the lower flight of steps and the carriage-way is in some places less than 6 ft. wide; and at this part the carriageway of St. Martin's-place is only about 37 ft. wide. The Local Authority have agreed with the church authorities for the reconstruction of the steps in such a way as to remove the landing on the west side of the portico and to lessen the width of the landing on the south side. A continuous flight of steps will lead from the western front of the portico to the footway of St. Martin's-place, and the effect of the abolition of the landing will be to widen the footway to about 9 ft. In consideration of the Local Authority undertaking the work, the church authorities will surrender without money-payment the land to be added to the public way. We regret that it is not possible at the present moment to increase the width of the carriageway; but, in our opinion, any increase in the width of the thoroughfare at this part, whether carriageway or footway, must be of great advantage to traffic generally. The vehicular and pedestrian traffic at this spot is enormous, and consists, not of local traffic, but of that going to and from all parts of London. Before approving the plan submitted by the Local Authority we considered alternative schemes with a view to the Council concurring in the adoption of the most suitable scheme to widen St. Martin's-place without interfering in an undesirable way with such a prominent and well-known building. One suggestion made to us was that to widen the thoroughfare the steps should be set back to a position within the line of the columns fronting the church; another was to substitute for the steps a vertical wall on the west side of the columns; whilst a third alternative method would involve the setting back of the church about 30 ft. further to the east, necessitating the rebuilding of portions of the edifice. To all these alternative suggestions, however, there are objections, and after full consideration we have come to the conclusion that the proposal made by the Local Authority is the most suitable, and likely to detract least from the architectural effect of the present arrangement of the steps. From contemporary prints it would appear that the lower flight of steps formed no part of the original design, but was added later when the gradients of St. Martin's-lane and Duncannon-street were readjusted.

The Royal Institute of British Architects, who readily agreed to give the Council the benefit of

their views, have sent us a reply in which they express their opinion as follows :—

'The Council of the Royal Institute are strongly of opinion that the suggested removal of the landing, which now divides the flight of steps leading up to the portico, would be very detrimental to the appearance of the west front of this fine church. Owing to the fall in the ground from north to south, the lower steps are of necessity broken off where they merge in the ground line. An unsymmetrical base of this kind to a symmetrical portico would have a distinctly bad architectural effect, but by the ingenious device of dividing the flight of steps in the middle, a perfectly symmetrical base of seven unbroken steps is provided for the colonnade, while the lower steps, which must terminate unsymmetrically, are separated from the design of the building and do not form part of it. My Council feel therefore that nothing short of actual necessity could justify the removal of the landing or platform, while from the personal observation of its members and reliable information received, they are fully assured that no such necessity exists.

In the event of the widening of the public footpath ever becoming necessary, they have no doubt that the suggested setting back of the western steps is the least objectionable means of effecting the purpose. But even if on account of such necessity the landing be omitted from the steps in front of the portico, they strongly recommend that it should still be retained on the south side, where it would be useful in helping to preserve somewhat of a symmetrical appearance to the base of the portico.

While considering the question of the appearance of this portico, my council beg leave to suggest whether it would not be possible to remove the cast iron railings now fixed at the top of the steps and between the columns, as they constitute a serious disfigurement to the building.'

We understand that the above-mentioned statements represent the unanimous opinion of the past Presidents and the President and Council of the Institute.

After a full and careful review of all the facts, and having regard to the opinion expressed by the Royal Institute of British Architects, we have decided to advise the Council to contribute towards the cost of the work proposed to be undertaken by the Local Authority, subject to the Council of the City of Westminster agreeing to retain the platform in the steps on the southern side of the church. We are impressed by the fact that the great extent of the traffic along St. Martin's-place necessitates the widening of the thoroughfare, and we consider that the least objectionable method of providing for this is by adopting the proposal made by the Local Authority, subject, however, to the qualification in regard to the retention of the platform on the south side of the church. We are not prepared, however, to advise the Council to arrange for the removal of the cast-iron railings from the top of the steps, as suggested by the Royal Institute, because we consider such a course most undesirable, although we admit that architecturally they detract somewhat from the appearance of the building.

When the Local Authority made application to us in July, 1900, they stated that the cost of the proposed work was estimated at 608*l.* They have since informed us, however, that as accidents frequently occur they felt compelled to undertake the work at once to secure its completion before the winter sets in, and they therefore entered into a contract amounting to 811*l.* 10s. 2d. We quite agree with the Local Authority as to the urgency of the work. We consider that the Council may reasonably contribute one-third, not exceeding 270*l.*, of the net cost of the scheme now suggested. We have caused to be hung in the Council-chamber a cartoon plan showing by black lines the present position of the steps and by red lines the proposed alteration. We recommend :—

That the estimate of 270*l.* submitted by the Finance Committee be approved, and that, subject to the Council of the City of Westminster agreeing to retain the platform in the steps on the southern side of St. Martin's Church, the London County Council do contribute, on the usual conditions, one-third of the net cost of the reconstruction of the steps in front of St. Martin's Church in such a way as to increase the width of the footway on the eastern side of St. Martin's-place to about 9 ft., as proposed by the Local Authority, such contribution not to exceed the sum of 270*l.*"

Colonel Probyn moved the adoption of the Report, as the Chairman of the Committee (Dr. Longstaff) refused to do so. The ecclesiastical authorities had consented to give up the steps to be dealt with for the public benefit, and the Local Authority fully recognised the importance of the improvement. What was proposed was to do away with the "tableland" and to add 2 ft. to the public footway—a loss to the church of very slight account, but a considerable gain to the public.

Mr. Shaw Lefevre pointed out that the architects reported that the alteration would seriously affect the architectural effect of the church, and that nothing short of actual necessity could justify the removal of the landing or platform. They also stated that, should the widening of the footway ever become necessary, they had no doubt that the suggested setting back of the western steps was the least objectionable means of effecting the purpose, but they strongly recommended that the landing on the south side should be retained. That was the scheme adopted by the Committee, but in his opinion it was still objectionable and would interfere with the architectural features of the church. He thought that, as there was a strong professional feeling against the alteration, it would be better for the Council to take no part in it, and moved as an amendment that, in view of the report of the Royal Institute of British Architects, the Council was not prepared to take the responsibility of sanctioning the alteration by contributing any part of the cost.

Sir H. B. Poland, Q.C., seconded the amendment, and said that had the St. Martin's Vestry had before them the Report of the Royal Institute, they would never have sanctioned the alteration or entered into a contract for carrying it out. He felt that the iron railings at the top of the steps were an eyesore, and he could not think why, according to the Committee, their removal would be undesirable.

Mr. Parker supported the amendment, though not for the reasons already given. This was not an improvement from the public point of view, and the proposal, if carried out, would not do much to widen the road. What was needed was a thorough widening; the proposal before the Council was so trifling that the Council ought not to contribute to its cost. The Committee seemed to be troubling themselves a great deal about architecture, but it was not the business of the Committee to become a Committee of architectural experts.

The Hon. W. Peel, M.P., said he would be no party to the mutilation of this beautiful church. It was wholly unnecessary for the Council to assist in damaging the church for the sake of merely adding 2 ft. 6 in. to the footway. When they asked the opinion of a body like the Royal Institute they should be led by its Report. It would be little short of an insult, having asked the Institute for its opinion, to set it aside in the manner proposed.

Colonel Rotton said he hoped that the amendment would be carried. For anything the Council could do the alteration would be carried out, as the sum asked for was only 270*l.*

Mr. Beachcroft said he should have thought the matter would have been treated on the basis of an ancient monument, especially as the Council had spent 20,000*l.* on preserving a fifth-rate barber's shop in Fleet-street. No one who had seen the church could fail to see that a good deal depended on the maintenance of the steps as they are, though if it had been proposed to round the corner of Duncannon-street, he should have sacrificed his æsthetic views for utilitarian purposes and vote in favour of an improvement at this point.

Mr. Burns, M.P., was not prepared to help make the Council a zareba behind which the Westminster Council could shelter itself from the artistic and æsthetic views which London architects would undoubtedly bring to bear upon it for tampering with this church. No one could deny that there was congestion of traffic just by the church, and he was convinced that a widening was necessary. He suggested that one of the wealthy parishioners, such as Mr. Astor, should give the vicar of St. Martin's 10,000*l.* with which to engage a competent architect, under whose guidance they could underpin the whole church, including the portico, put it on a sliding gantry, remove it 40 ft. back, and give it an alignment with Duncannon-street. In that way alone could the widening of St. Martin's-place be carried out without injuring the church. He asked the Council to preserve itself from a suggested act of vandalism.

Colonel Probyn said it was absurd to use the word "vandalism," for the church would not be touched at all. Moreover, in the original drawings of the church there was no "tableland" at all between the steps. The "tableland" was put in so as to adjust matters when the level of St. Martin's-lane was disturbed at a later date.

Dr. Longstaff said that if this street required widening the easiest way would be to take down a portion of the National Gallery—that portion which was architecturally the least important. That could easily be done.

The amendment was then put and carried by a large majority.

Underground Electric Railways.—Replying to Mr. Leon, Mr. Benn (Chairman of the Highways Committee) said the Council had little control over underground electric railways, but they could oppose Bills before Parliament on the ground that in the interest of London some general system should be settled before the Bills were passed. He would bring the matter before the Highways Committee.

The Highways Committee proposed the adoption of an underground conduit system of electrical traction devised by Dr. A. B. W. Kennedy for use on the Council's tramways in South London. The traffic receipts on the Council's tramways for the past year were 392,360*l.*, as compared with 392,131*l.* in the previous year.

In reply to Mr. Boulnois, M.P., Mr. Benn said the estimated cost of the conduit system was 15,000*l.* per mile single and 30,000*l.* per mile double line.

Sanitary Inspectors' Examination Board.—The Public Health Committee reported as follows :—

"On October 9 the Council resolved to address a letter to the Local Government Board, asking that it might be authorised under clause (*c*) of the memorandum of association of the Sanitary Inspectors' Examination Board, to appoint five representatives to serve on that Board, and stating that the Council would be glad if the President of the Board would receive a deputation from the Council on the subject. The Board now state in reply that they have received applications from a number of bodies for representation on the Examination Board, but that, as that Board was only formed last year, it is considered inexpedient to make any alteration in its constitution until further experience has been had of its working; further, that a note shall be made of the Council's application, so that it may be considered whenever any alteration is made in the bodies represented, and that in these circumstances it does not seem necessary to trouble a deputation from the Council to attend."

Government Buildings.—Mr. Burns asked the Chairman of the Building Act Committee whether it was a fact that the new Land Registry Office was proposed to be built 80 ft. high, with two stories in the roof, and projecting 12 ft. in advance of the other buildings and the existing line of frontage, and whether steps had been taken to bring such a violation of the Building Act before the notice of the proper Government Department.

Mr. Goddard Clarke replied that a communication had been received from the First Commissioner of Works stating that he shared to a great extent the views of the Council in this matter, and the question was still under consideration.

Sir A. Arnold thought a deputation should emphasise the nature of the encroachment.

Tender.—On the recommendation of the Highways Committee, the tender was accepted of the Gilbert Arc-Lamp Company, Limited, for the supply, for the sum of 2,200*l.* 18s. 6d., of the arc-lamps required in connexion with the electric-light installation for the Victoria Embankment and Westminster Bridge.

Housing of the Working Classes.—Mr. Waterlow (Chairman of the Housing Committee) moved the reception of the Report of that Committee, which stated that the detailed accounts of the Council's workmen's dwellings had been sent to each member. He pointed out that the accounts showed a deficiency on the year's working of 1,157*l.*, which was 1,235*l.* less than the deficiency of the previous year. The deficiencies occurred on sites where the Council were forced to build. Had the central laundry on the Boundary-street area turned out successful, the loss would have been very slight. The Council had schemes in hand only awaiting the approval of Government, estimated to cost 863,000*l.*, and to give accommodation to 14,858 persons.

Mr. Bond, M.P., said that if they compared the Council with private dwellings' companies, it would be seen that nothing was provided in the Council's accounts for directors, and yet there was no profit for the ratepayers.

Mr. Waterlow said that if they crowded families into one room, no doubt they could pay 5 or 6 per cent., but he did not think the Council would agree to do anything of the kind.

The Site for a County Hall.—The Special Committee on New Offices recommended :—"That, in the opinion of the Council, it is not expedient that a site on the crescent island to be formed in connexion with the Holborn to the Strand Improvement should be reserved for the erection of new offices for the Council."

Mr. Corbett (Chairman of the Committee) declined to move the recommendation.

Mr. Shaw Lefevre, in moving the Report, said that the value attached by the valuer to the suggested site was 2,400,000*l.*, which was so enormous that the Committee felt that the Council could not go into it. Comparing the cost with other suggested sites, he might say they might get a site in Westminster for one-fifth or one-sixth the figure, and with a site in Spring Gardens there would be a saving of 50 per cent. There were other objections to the site. It was somewhat further removed from the public offices; it was a noisy position; and it was also in a district abounding with theatres and saloons, and he did not think it was a desirable position to which to take their very large staff.

Mr. Goulding, M.P., expressed the opinion that it was time party politics were put aside, and that they should decide upon a County Hall which would be worthy of the work the Council had to do. He moved to add the following words to the recommendation, viz.:—"But that the Committee bring up a Report without delay as to what site they do recommend for the erection of a County Hall and offices."

Mr. Horniman seconded the amendment, and it was carried.

The recommendation as amended was then agreed to.

The Council adjourned shortly before seven o'clock.

APPLICATIONS UNDER THE 1894 LONDON BUILDING ACT.

AT the meeting of the London County Council on Tuesday the following applications under the 1894 Building Act were considered. Those applications to which consent has been given are granted on certain conditions. Names of applicants are given in brackets. Buildings are new erections unless otherwise stated:—

Line of Frontage.

Woolwich.—A one-story shop on part of the forecourt of No. 31, Plumstead-road, Plumstead (Mr. P. Chinnery).—Consent.

Width of Way and Line of Frontage.

Newington, West.—A two-story warehouse on the south side of Peacock-street, Newington, between Nos. 12 and 18 (Mr. A. W. Reed for Messrs. J. H. & J. W. Kent).—Consent.

Projecting Iron Structure.

Rotherhithe.—A steel grain-shoot across the public way of Church-passage, Rotherhithe, for the purpose of conveying grain between the warehouses in the occupation of Messrs. Dudin & Sons, on opposite sides of that street (Messrs. W. A. Crips & Son for Messrs. Dudin & Sons).—Refused.

BOOKS RECEIVED.

INWOOD'S TABLES FOR THE PURCHASING OF ESTATES. Twenty-sixth Edition. Revised and Extended by W. Schooling, F.R.A.S. (Crosby Lockwood & Co.)

WATERWORKS DISTRIBUTION: A PRACTICAL GUIDE TO LAYING OUT SYSTEMS OR MAINS. By J. A. M'Pherson, A.M.Inst.C.E. (B. T. Batsford.)

THE CATHEDRAL CHURCH AND MONASTERY OF ST. ANDREW AT ROCHESTER. By W. H. St. John Hope. (Mitchell & Hughes.)

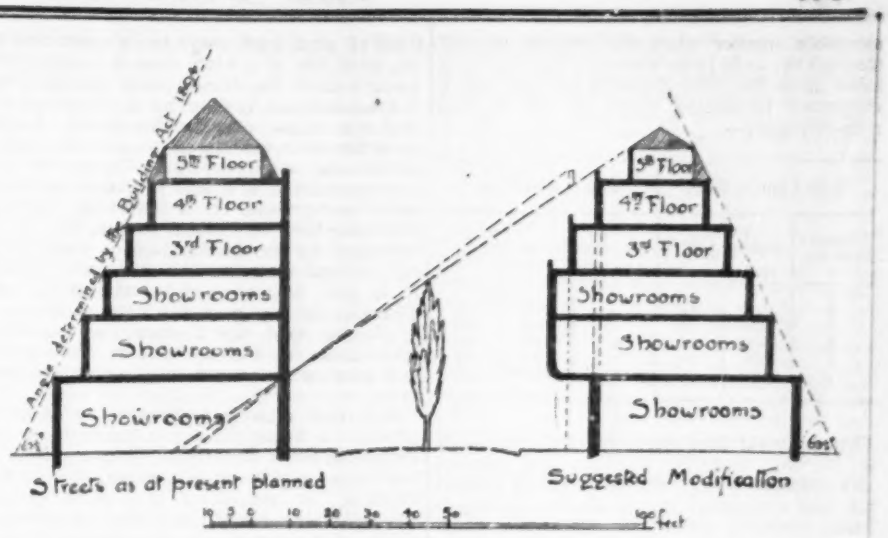
OLD COTTAGES AND FARMHOUSES IN KENT AND SUSSEX. By W. G. Davie and E. Guy Dawber. (B. T. Batsford.)

Correspondence.

***To the Editor of* THE BUILDER.**

STREET BUILDING FOR CITIES.

SIR,—The main object in our town streets is to secure the maximum of light and air, and the tendency of modern requirements is to curtail our quantum. In our business streets, each new shop, in self-defence, makes its ground floor taller than the last, in order to get light to the back of the showroom, and the showrooms, of course, are the justification of the building. The importance of the wind sweeping down our streets and purifying them is most felt, of course, during foggy weather, when there is little air stirring and the fog lingers, baffled and imprisoned, between the high walls. The bridges across the streets suggested by Sir Frederick Bramwell would



be a serious evil, as checking the circulation of air. The suggestion I would make is, that we should construct the façades of our streets somewhat as shown by the diagram—that is to say, in a series of vertical fire-proof compartments, relying on the party walls for this purpose; and bridging across from party-wall to party-wall, supplemented where needed by steel concrete-cased columns, to form the façades. Consequently, if fire broke out, it might be possible to confine the damage to that particular compartment whence it originated. The ground-floor walls to be set back to enable the shop gazers to view the goods from the outside, sheltered by the projecting first floor which stands out beyond the frontage line a bow-window's width. The third floor resumes the frontage line and the flat set back is used as skylight to increase the lighting of the top showroom. Above come residential quarters, each floor with a wide terrace, which would add, I think, to their attractiveness; and so compensate for the loss of area in the two top floors. By this section it is clear that the air in the streets can be more easily changed and more briskly swept along, whilst the light would penetrate further into the ground-floor showrooms. It is also important that when trees are planted along a street they should be of a shape proportioned to the sectional area of the street, and planted in the centre of the roadway, where they may have a chance to prosper, instead of on the sidewalks, where they must prove serious obstructions, by their presence, to the aims and objects of the shops.

HALSEY RICARDO.

NORWICH LIFE INSURANCE OFFICES' COMPETITION.

SIR,—We lately received an invitation to take part in a limited competition for the above, but the conditions we considered were unfair, and as we could not get them altered we declined to compete.

We make this communication in order to assist those who are endeavouring to secure that competitions shall be conducted according to the regulations laid down by the Royal Institute of British Architects, and to maintain the best traditions of the profession.

We subjoin a copy of the letter which we addressed to the directors.

E. BOARDMAN & SON.

Norwich, November 27.

Copy of Letter Referred to.

"To the Chairman.

November 17.

New Insurance Office Premises.

DEAR SIR,—The directors having honoured us with an invitation to take part in a competition for the proposed New Office Buildings, we regret that we must decline to do so if the conditions are adhered to. We respectfully ask you as Chairman to bring the matter before the Board.

The Royal Institute of British Architects have issued a carefully-considered 'Form' for the conduct of competitions, but your conditions are at variance with this in some most important points. No premiums are offered. No provision is made to recompense the competing architects if the buildings are not erected. The assessors appointed are apparently servants of the Board, and the firm practise as surveyors and not architects.

The President of the Royal Institute of British Architects only last week made the question of competitions a foremost one in his inaugural address, and we appeal to the professional gentlemen on the board to say whether or no it is proper and fitting for practising architects who are members of the Institute to undertake work under conditions which are contrary to the best interests of the profession.

We are sending a copy of the Institute conditions and the Presidential address to all the members of the board.

Regretting we have to trouble you in the matter, we remain, dear Sir, yours faithfully,

EDW. BOARDMAN & SON."

The Student's Column.

LESSONS IN ELECTRICAL ENGINEERING.

20. ELECTRIC WELDING—THOMSON PROCESS—BENARDOS PROCESS—COPPER REFINING—OZONE—ALUMINIUM—CALCIUM CARBIDE—CORBORUNDUM.

WHEN iron or steel is heated in a fire until it is at a white heat it assumes a pasty condition, and two pieces can be firmly united together by hammering. This process is caused welding, and to do it properly requires considerable skill, as the heat must be nicely regulated and the ends have to be clean. Some twenty years ago Professor Elihu Thomson, when experimenting by passing discharges from a Leyden jar through a fine wire coil, found in one of his experiments that the ends of a thick wire coil surrounding the thin wire coil were welded together. This led to further experiments, and finally he evolved the process of electric welding which bears his name.

In the Thomson process an alternating current transformer is used which has many turns of fine wire in the primary coil, and only one turn with its ends fitted with heavy clamps in the secondary. The two pieces of metal rod to be welded together are fixed in these clamps and pressed together. The secondary now forms a complete circuit, and if we maintain a steady pressure of 300 volts at the terminals of the primary circuit, then a very large current at a very low pressure is induced in the secondary. Now most of the resistance of the secondary circuit is at the joint, hence since the heat developed in a portion of a circuit is proportional to the resistance of that portion, nearly all the energy of the current is expended at the joint which is raised in a few seconds to the required temperature. It is found that the surfaces in contact are all at nearly the same temperature, because if one portion is cooler than another it will have less resistance, and hence a larger fraction of the current will flow by that path and so heat it. The method is also a very clean one, and the operator can inspect the weld during the whole process. An electric weld can be made much more quickly than by the smith's process, and it is in every way more satisfactory. Nearly every metal can be welded by the electric process, whilst only a very few can be welded by the other process. The ends of a solid ring can also be welded, for although some current goes round by the longer path, yet owing to the choking effect produced by the back E.M.F. of self-induction, this branch current is con-

siderably smaller than the current passing through the ends to be welded. The following table gives the time required and the power consumed in making welds of iron or steel rods or pipes :—

Round Iron or Steel.			Iron or Steel Pipe.		
Diameter in inches.	Watts.	Time in Seconds.	Inside Diameter in inches.	Watts.	Time in Seconds.
¼	1500	10	½	6700	33
⅜	2500	15	¾	7800	40
½	4800	20	1	12950	47
⅝	6700	25	2	31350	84
¾	10000	30	3	72000	106

Thus to weld two pieces of steel pipe each ¾ in. in diameter together we require 10 kilowatts, or 13·4 horse-power, to be applied for half a minute. Nearly all this energy is being expended at the weld, yet as the whole operation is over in half a minute, the metal is quite cool at a distance of two or three inches on either side.

In the Benardos process of welding use is made of the electric arc. The workman holds a carbon which is joined by a flexible cable to the negative pole of a battery of accumulators, and the metal to be welded is joined to the positive pole. If he now touch the joint that is to be welded with the carbon and lift it about an inch from the metal, a brilliant arc is started which rapidly raises the metal to the welding temperature. Owing to the glare, it is necessary to wear dark glasses during the process. Some very difficult welds, such as welding steel sheets into seamless barrels, mending broken teeth in cast-steel gear wheels, and even cutting out portions of boilers and welding in new pieces with the boilers in their working position, have been successfully effected by this process. Very large currents are required, usually from 300 to 500 amperes, and the pressure required needs to be at least 80 volts, as steadying resistances have to be placed in series.

Perhaps the most important application of electrolysis at the present time is to copper refining. About one-half of all the refined copper used in the world is produced electrolytically, and the great improvement in the purity of the copper is shown by the fact that the specific resistance of the copper in the cables used for electric lighting is less than one-half the specific resistance of the copper used in the first Atlantic cable. If we put two copper plates in a solution of copper sulphate and pass a direct current from one to the other, then copper is deposited on the plate the current leaves by, and the plate by which the current enters loses in weight. Copper refining is simply an elaboration of this simple experiment. The impure copper is made the positive plate, that is, the plate connected to the positive pole of the dynamo, and the plate on which the copper is to be deposited is connected to the negative pole. A current of one ampere deposits only 1·1739 grammes of copper per hour, and remembering that there are 453·6 grammes in a pound, it will be seen that very large currents are necessary. If the currents employed are too large for the size of the plates, then the deposit is flaky. If a rapid circulation of the electrolytic solution be kept up over the plate on which the deposit is taking place, much larger currents can be used, the deposit still remaining tough and smooth. As the yearly output of electrolytic copper is now about 200,000 tons per annum, the great importance of this industry will be apparent.

It has been known for many years that the peculiar odour produced when a frictional electric machine was worked was due to ozone. Just as diamond is an allotropic form of carbon, so ozone is an allotropic form of oxygen. It has not yet been obtained in a perfectly pure state. If we allow sparks to take place in oxygen, its bulk is reduced and a certain proportion of ozone is formed. The molecule of ozone is in an unstable condition. It consists of three atoms, whilst the molecule of oxygen contains only two. Ozone is a very powerful oxidising agent, and hence it is very efficient as a germicide.

Of the many forms of apparatus invented to produce ozone on a commercial scale, Mr. Andreoli's ozoniser is, perhaps, the simplest and most efficient. It consists of two combs of aluminium separated from one another by a sheet of glass, each comb being connected to the terminals of a high tension transformer. As each comb has thousands of points, ozone is manufactured rapidly by the electrostatic discharge taking place at the points. Large quantities of ozone can thus easily be manufactured at small expense. Many of the secondary chemical effects produced by ozone are of great value. It is sometimes used for bleaching beeswax, tallow, grease, &c. It is necessary for the manufacture of some artificial perfumes like vanillin and heliotropine. It is also largely used for thickening and bleaching oils and varnishes. Messrs. Siemens & Halske have two factories in Germany where bleaching is done by ozone. Cloth, linen, and yarns are bleached in one of them, and in the other starch is bleached and refined.

The most valuable applications of ozone at present are in medicine and sanitary science. In all diseases where organisms are present it has been used with advantage, and in the treatment of unhealthy wounds it greatly alleviates the pain and takes away the offensive smell. It is very efficient for sterilising water, as all impurities are oxidised and the microbes destroyed. From experiments made on Thames water, Mr. Andreoli calculates that a cubic yard could be completely sterilised by an expenditure of a tenth of a Board of Trade unit in his apparatus.

Dr. Fröhlich, of the firm of Siemens & Halske, states that an ounce of ozone will bleach 110 lbs. of linen as well as it could be bleached on grass in three days. It will also bleach and refine 100 lbs. of potato starch, taking away all the bad taste and smell, and leaving the colour perfectly white. He also states that an ounce of ozone in a room whose capacity is 8,000 cubic yards makes the air almost unbearable for healthy persons.

The manufacture of aluminium in 1885 was on a very limited scale, the world's production for that year being under four tons. It was made by a chemical method—namely, the sodium reduction process, and the selling price was 2*l.* 10s. per lb. In this year Mr. C. M. Hall, a young American, while still at college, experimented on the electrolysis of fused aluminium salts. He attempted to find a substance which would form an electrolyte for alumina at high temperatures so that the aluminium might be separated from it. After many unsuccessful attempts he managed to deposit aluminium by means of an electric current by using melted cryolite as the electrolyte. Cryolite is a combination of sodium and aluminium fluorides, and has a low melting point (900 deg. C.). In 1888 the well-known Pittsburg Reduction Company was formed to make aluminium by Hall's process, and at the end of the year it was selling aluminium at 20s. the pound.

About the same time as Hall, M. Héroult patented a process in France for obtaining aluminium from a bath of fused cryolite and alumina by means of electric currents. The development of the manufacture of aluminium in Europe was, however, much slower than in America. The largest company in Britain is the British Aluminium Company, which works on the Héroult system. They obtain the raw material from their mines at Glenravel, in Ireland. It is then conveyed some twenty miles to their alumina factory at Larne Harbour, where it is chemically treated, and the alumina is obtained in the form of a very fine powder. It is found that five tons of the raw bauxite produce about two tons of alumina, and this in turn produces about one ton of metal. The alumina after being dried is packed in steel casks and conveyed to Foyers, in Scotland, by steamer.

At the Falls of Foyers a channel has been constructed to lead away part of the water from above the upper fall to the factory, a distance of about three-quarters of a mile. The turbines are of the vertical type and are each capable of transmitting 700 h.-p. to the dynamo which it drives. The dynamos produce 8,000 amperes at a pressure of 60 volts. The current leaves the dynamo by means of large bare copper cables, which convey it to the furnaces in which the alumina is decomposed. The pure aluminium is then sent to the company's rolling mills in Staffordshire.

Aluminium wire is now quoted at 224*l.* per ton, or 2s. per lb., and sheet aluminium is about 15 per cent. cheaper. Although the cost has been so lowered there has been a notable improvement in the quality of the commercial metal. M. Minet has analysed specimens made in 1890, 1893, and 1897, with the following results, the numbers being percentages :—

Composition of the Metal.	In 1890	In 1893	In 1897
Silicon	0·90	0·25	0·03
Iron	0·40	0·40	0·12
Aluminium	98·70	99·35	99·86

For reasons we have previously stated aluminium is being extensively used for long distance power transmission schemes, and it is also used for reducing refractory oxides. It is used extensively in the iron and steel foundry where a small quantity is added to the metal immediately before casting. It is also used to make cooking utensils. For shipbuilding it has not hitherto proved a success. Part of the sheathing of the yacht *Defender* was corroded, although the metal used in its construction was exceptionally pure. It is extensively used in warships as a substitute for inflammable wood, and it is also sometimes used instead of lithographic stones.

One of the most important electro-chemical industries is the manufacture of carbide of calcium. The discovery of the method of manufacture was made accidentally by Mr. Willson, of the Willson Aluminium Company, in 1893. As originally produced it was a by-product of the electric furnaces used for reducing refractory materials. The materials used in its manufacture are finely-ground lime and coke. These are put into the electric furnace and subjected to a very high temperature. The furnace is a brick-built chamber containing two large carbon electrodes, which gradually burn away under the intense heat, but their distance apart can be regulated by means of screw rods to which they are attached. In order to get 1 ton of carbide 300 h.-p. has to be given to the furnace for twelve hours. It is therefore obvious that cheap power is necessary for its manufacture. The present wholesale price of carbide of calcium is about 20*l.* a ton.

For operating electric furnaces polyphase currents offer many advantages over direct currents. With direct currents it is impossible to maintain several arcs in parallel owing to the difficulties of regulation, but with polyphase currents we can use as many carbons as there are phases. For example, with three-phase currents we can have three carbons inclined to one another at 120 deg., the molten mass forming the neutral point. In electric furnaces temperatures as high as 3,500 deg. C. have been obtained, and carbon has been vapourised.

A pound of calcium carbide will, when mixed with water, produce five cubic feet of acetylene. This gas in an ordinary burner burns with a very smoky flame, but in burners specially constructed to prevent the formation of smoke it burns with great brilliancy, the light it gives being between ten or twenty times that given by coal gas. It has, moreover, several advantages over coal gas. It can be generated in a very simple and ready manner from the carbide, and hence can be used for illuminating purposes in country houses without the expense of an outside gasworks. It gives out less heat and consumes less oxygen for a given amount of light than coal gas. The disadvantages are possible dangers in connexion with explosions and the difficulty of storing it in bulk. Considerable progress has recently been made in this direction, and there is an ever increasing demand for calcium carbide.

A recent industry that has greatly interested scientists is the Villon process of manufacturing alcohol from calcium carbide. The carbide is decomposed into acetylene in the usual manner, and the acetylene is converted into ethylene gas by passing it through a solution of chromium and ammonium sulphates. The ethylene gas is absorbed by sulphuric acid and the product is distilled after water has been added. This distillate is ethyl-alcohol and is used as a fuel in motor vehicles. With carbide at 20*l.* a ton it could be made at a little over 1s. per gallon.

Silicium carbide or carborundum is now much used for boring, grinding, shaping, &c., and is displacing emery and corundum. The raw materials required for its manufacture are coke, sawdust, salt, and sand. These are put into the furnace, which at Niagara is in the form of an oblong box 12 ft. in length, 3 ft. in width, and 3 ft. in depth. In the centre of either end are the electrodes, consisting of six-

teen carbon rods, each of which is 3 in. in diameter. When the circuit is closed no apparent change takes place for about half an hour, although about 1,000 h.-p. is being expended on the furnace. Then a slight odour is perceived owing to the formation of carbon monoxide. After three or four hours the whole furnace is enveloped in blue flames, caused by the combustion of the escaping gases. Cracks also appear along the surface of the bricks, through which appear yellow sodium flames. The current is kept on for twenty-four hours and then the furnace is allowed to cool. The side walls are then taken down and the upper crust is cut through with large steel bars and raked off. The inner crust is then removed with a spade and the crystalline silicium carbide exposed.

The crystals are of all colours and sizes. They are ground down to powder and after being washed with dilute sulphuric acid the commercial product is obtained. This is made up into hones, files, rubstones, and cloth by being mixed with a binding material and then moulded under hydraulic pressure and vitrified in kilns. "Carborundum is much superior to emery, and there has sprung up a great demand for it. It has been successfully employed in polishing diamonds. Great additions have recently been made to the plant of the Carborundum Company at Niagara Falls.

Amongst other electro-chemical industries we may mention the manufacture of alkalies and bleach which is done electrolytically in about thirty factories. The tanning of hides, the seasoning of timber, the making of potassium chlorate, and the manufacture of sodium hypochloride are a few of the minor electrical industries which may in the future rapidly develop.

OBITUARY.

MR. HENRY CURREY.—We regret to announce the death, on Friday, November 23, at his residence, The Chesnuts, Lawrie Park, Sydenham, of Mr. Henry Currey, of No. 37, Norfolk-street, Strand, W.C., aged eighty years. Mr. Currey, who was an Associate of the Institution of Civil Engineers and a Fellow of the Surveyors' Institution, was elected Associate of the Royal Institute of British Architects in 1848, and Fellow in 1856, and a Vice-President for 1874-7 and 1889-93. He was during a long period architect and surveyor to the Governors of St. Thomas's Hospital, and in that capacity planned and designed for them his most important work—the hospital buildings on the Albert Embankment, of which the long range of pavilions, connected by corridors and arcades, constitutes a prominent feature of the riverside view as seen from Westminster Bridge, and forms a striking contrast to the opposite Houses of Parliament. The Governors purchased the site—about 8½ acres, whereof half had been reclaimed from the foreshore at Stangate—from the late Metropolitan Board of Works for 90,000*l.*, at the time of the construction of the Embankment—begun in July, 1866, and completed (but since widened at Vauxhall) in November, 1869: on August 8, 1865,* we published a view, with plans, of the buildings, and on June 24, 1871,* another view, with plan, of the two middle pavilions. The Queen opened the new hospital on June 21, 1871, having laid the first stone on May 13, 1868. The new medical schools were opened in June, 1894. The governing body adopted the detached pavilion system—extended in this instance through the exigencies of a narrow site—after a committee had visited many hospitals on the Continent. A description of the plans will be found in a paper read by Mr. Currey at a meeting of the Royal Institute, and reported by us on January 28, 1871. With a total frontage of 900 ft. the blocks stand 125 ft. apart; the central space being 200 ft. in length. They were designed for 600 beds in wards measuring 28 ft. by 120 ft. and 15 ft. high, for twenty-eight beds apiece, allowing each patient a space of 1,800 cubic feet. At the south end are the schools and a museum, 85 ft. by 30 ft. and 34 ft. high, with two galleries, the southernmost wing being for special cases and smaller wards; at the bridge-foot are offices and separate residences for the treasurer and four resident officers.

In giving evidence before the Hospital Commission, February, 1891, Mr. Brass, receiver of the hospital estates, is reported to have stated that the new buildings cost 969*l.* per bed, the out-patients' side included.

In 1861-2, Mr. Currey built the hotel at the London Bridge railway terminus, which was illustrated in our columns of June 22, 1861.* The subsequent enlargement of the London, Brighton, and South Coast and South-Eastern (old) terminus, originally designed by Henry Roberts, in 1843-4, in conjunction with either Sydney Smirke or George Smith—the authorities do not agree on the latter point—occasioned the destruction of nearly all the St. Thomas's Hospital buildings in the Borough, Southwark, to which Wren, in 1692-1711, Samuel Robinson, surveyor of the hospital estates, and his partner, James Field, in 1814-42, Sir Robert Smirke (the principal façade), and Sir Charles Barry (the new wing), had in succession contributed various portions. Amongst his other architectural work we may mention some warehouses in St. Thomas-street, Southwark, for Messrs. Bevington & Sons, which we illustrated in our number of March 20, 1875;* St. Paul's Church, Grove Park West, near Chiswick railway-station, built chiefly at the charges of the late Duke of Devonshire, and enlarged by Mr. Currey in 1892; the Pump Room at Buxton, 1875; and a lych-gate at St. Bartholomew's Church, Westhill, Sydenham, for the Mayow W. Adams Memorial Committee. Together with his son, Mr. Percivall Currey, he carried out, in 1898, the repairs and superintended the redecoration of the church of St. Clement Danes in the Strand, and prepared the plans and designs for the recent reconstruction and extensive enlargement of the Queen Anne's Bounty Offices in Great Smith-street, Westminster, established in 1704. Messrs. Henry and Percivall Currey acted also as honorary architects in respect of the planning and designing of the St. Clement Danes and Clare-market Parish Hall, 1897-8. We will add that Mr Henry Currey officiated as assessor to the Metropolitan Asylums Board in the two important competitions for their Southern Hospital, and their new chief offices on the Victoria Embankment, Whitefriars, Mr. E. T. Hall being the architect. Of the latter building, erected at a contract price of 47,532*l.* and opened in July last, we published a perspective view, with plan, on June 11, 1898. For the Southern Hospital the Board have adopted Messrs. Treadwell & Martin's plans upon the cottage system, to be carried out (as revised) at an estimated total cost of 284,312*l.*, the cost per bed being reduced from 395*l.* to about 355*l.*, and that of the structure being 178,112*l.*

* Out of print.

GENERAL BUILDING NEWS.

ALTERATIONS TO ST. CHARLES'S CHURCH, HULL.—The dome and sanctuary, the memorial to the late Canon Sullivan, was opened at St. Charles's Catholic Church, Hull, on the 25th ult. The dome is situate immediately over the centre of the sanctuary at a considerable height from the floor. The outside of the dome is covered with copper and finishes with a gilded ball and cross. The ceiling below the dome and on either side of the sanctuary is groined and panelled. The side and end walls below the main cornice are filled with niches, which are to receive hereafter statues of patron saints. The sanctuary is divided from the nave by columns, the space between them and the wall pilasters being filled in with enriched canopied niches with the statues of St. Joseph and St. Charles. The altar has been taken down and set back some 4 ft.; a baldachino has been erected over it, with a carved and gilded canopy suspended immediately over the throne of the tabernacle. The floor of the sanctuary has been laid with a vitreous mosaic pavement. The steps are of rough royal marble. There is being executed a new oak pulpit, with canopied sounding-board. It will be placed under the first arch of the nave arcade, on the Gospel side. There will also be carved oak stalls in the sanctuary. The whole has been designed in the Italian Renaissance style, from plans and under the superintendence of Messrs. Brodrick, Lowther, & Walker, of Hull. Messrs. G. Jackson & Son, of London, have executed the fibrous plaster work, Mr. Levitt the brickwork, Mr. G. J. Scott the joiner's work, Mr. Quibell the mason's work, and Mr. J. Morley the plumbing and electric lighting. The colour decorations and the pictures have been done by Herr H. Immencamp, of Hull.

MISSION CHURCH, OLD HILL, STAFFORDSHIRE.—A mission church, dedicated to St. James, has been erected in the Waterfall-lane district of Blackheath, Old Hill, from designs by Mr. A. Ellis, of Birmingham. The building will accommodate 250 persons.

PRESBYTERIAN CHURCH, WHITLEY.—The new Presbyterian church at Whitley was opened on the 23rd ult. The new church measures 90 ft. by 42 ft., and provides accommodation for about 470 worshippers. Included in the building is a minister's vestry 16 ft. by 9 ft., a small hall 29 ft. by 16 ft., and a central corridor 4 ft. 6 in. wide, communicating with the church hall, which was erected about four years ago. The building is a Gothic structure, with a chancel behind the pulpit. The church is heated with hot water on the low-pressure system. The contractors are Messrs. Fishburn & Co., of North Shields, Mr. Wm. Bowden, of Whitley, acting as clerk of works, and the plans have been prepared by Mr. Henry Gibson, of North Shields.

RESTORATION OF TOWER, CLARE CHURCH, SUFFOLK.—The tower of Clare Church was reopened on the 21st ult., after restoration. The work has been carried out under the supervision of Mr. Detmar Blow, the architect to the Society for the Protection of Ancient Buildings. The church bells have been rehung by Messrs. Day & Son, of Eye, Suffolk. The work has cost about 1,600*l.*

TEMPERANCE INSTITUTE AND HALL, DUDLEY, WORCESTERSHIRE.—The formal opening of the new Temperance Hall and Institute in High-street, Dudley, took place on the 21st ult. The building is of brick with an ornamental frontage of terra-cotta facings. On the right-hand side of the main entrance is a café, and on the left a first-class refreshment-room; whilst directly at the rear, and approached by a broad passage with encaustic tiled dado, is a hall, 75 ft. long by 42 ft. wide, capable of seating 750 people, with a gallery, stage, and all necessary accommodation for public meetings. Underneath the café and refreshment-room is a smoke and general dining room, with kitchen, stores, &c., and directly below the large hall is the gymnasium. The first floor consists of reading and committee rooms for the use of the members of the Temperance Society, and an assembly-room, extending the whole width of the building and capable of seating 150 people. On the floor above is a suite of similar rooms, which will be principally devoted to recreative purposes; whilst the roof, which is approached by a staircase and is flat, asphalted, and provided with parapet, is intended for a promenade in summer. Exclusive of the site, the total cost of the building, with fittings, will be about 8,000*l.* The building has been erected by Messrs. Webb & Round, Dudley, from the plans of Messrs. Wood & Kendrick, West Bromwich.

PAVILION, WESTON-SUPER-MARE.—The Urban District Council of Weston-super-Mare having applied to the Local Government Board for permission to borrow an additional sum of 5,203*l.* in connexion with the erection of a pavilion at Knightstone, Col. A. J. Hepper held an inquiry into the matter at the Town Hall, Weston-super-Mare, on the 16th ult. The original loan, which was based on estimates made in 1898, was 14,300*l.*, but owing to the increase in the prices of materials, and the fact that certain filling behind the sea-wall would be needed, it was found that the work could not be carried out for a less amount than just over 19,500*l.* At the inquiry just held, Mr. Hugh Nettleton, the Town Surveyor, explained in detail the works in connexion with the substructure, the sea-wall, &c., and Mr. J. S. Stewart, the architect of the pavilion, explained the details of the superstructure.

EPILEPTIC COLONY, WARFORD, CHESHIRE.—The preparations for the establishment of the Lewis epileptic colony at Warford, in Cheshire, are, says the *Manchester Courier*, making rapid progress. A considerable amount of work has already been accomplished in the way of draining and laying out the grounds, and the contract has been let for the erection of the numerous buildings for the housing and treatment of the epileptics forming the colony. The area within which the buildings are to be placed covers, roughly speaking, 3,000 yards, and the site is stated to be laid out like a beautiful park. The remainder of the estate will be available for recreation grounds, and for gardening and farming pursuits, in which the inhabitants of the colony will employ a portion of their time. The patients will live in detached homes in the form of two-story buildings, some accommodating twenty and others twenty-four inmates. The accommodation is also to include an infirmary, a recreation hall, observation blocks, kitchens, an administrative block, and laundry. An engine-house, water-tower, and workshops will also be provided. The administrative block will face the main entrance, and the recreation hall is to be placed a short distance in the rear of this building. The homes for the patients will be on either side, and the other buildings will be conveniently distributed over the site. The land is situated on the main road from Knutsford to Chelford. The architect is Mr. Alexander Graham, of London, and the contract for the building work, which amounts to somewhere about 50,000*l.*, has been secured by Messrs. W. Brown & Son, of Salford. In order to facilitate matters, brickmaking will be commenced on the site almost immediately.

PARISH HALL, STROOD.—The new parish hall, which is situated at the top of Brompton-lane, and which forms an addition to the Church's work at Strood, was dedicated by the Bishop of Rochester recently. The site of the hall, irregular in shape, has a frontage of 114 ft. to Brompton-lane, and 93 ft. 6 in. to Moore-street. The building has been placed close to the upper boundary in order to leave room for a church when the need arises. The walls are of stock bricks, with red brick dressings; the roof is covered with Broseley tiles. The entrance is by a side porch, the door of which faces directly down Brompton-lane, the main exit being by a separate pair of doors opening outwards in the centre of the main front. Within is a rectangular hall, 55 ft. by 33 ft., with the roof open to the collar at the height of 21 ft. 6 in. The artificial lighting is by Welsbach incandescent gas, and the heating is by stoves. The architect is Mr. E. F. Cobb, and the builder Mr. W. Coker, of Halling.

CO-OPERATIVE STORES, DARWEN, LANCASHIRE.—The new Central Stores, on the Green, Darwen, were opened recently. Messrs. Sames & Green were the architects.

MUSIC-HALL, CLAPHAM JUNCTION.—On the 26th ult. the new Grand Palace of Varieties at Clapham Junction was opened. The exterior of the building has been executed in red brick and red stone, and has for its central feature on St. John's Hill a group of entrances to the grand vestibule, with varied arcades. On either side of the central arrangement two projecting turrets rise some 80 ft. above the pavement level. The vestibule has marble

* Out of print.

steps, mosaic floor, decorated walls and ceilings, and on the right is the grand staircase to the circle. The pit is a spacious one, and the level of the ceiling is so arranged as not to curtail the range of vision in any way. The interior decoration has been treated in cream and gold. The hall will accommodate from 2,500 to 3,000 persons, and the stage is 68 ft wide and 28 ft. deep, the distance from the stage door to the gridiron being 53 ft. The building is lighted throughout by electricity. Mr. Ernest A. E. Woodrow was the architect.

FOREIGN.

INDIA.—The last section of the Hyderabad-Godavari Valley railway from Parhand to Basar, eighty-seven miles, has been opened for traffic, and the line is now linked from Secunderabad Junction to Manmar Junction.——The important bridge at Dihing has recently been completed; it is in six spans of 100 ft. triangulated girders.——A new dock is about to be constructed at Luff Point, near Calcutta, to facilitate the coal export trade, which at present is in a congested state.——The marine approaches to the Port of Calcutta are to be greatly improved, and a powerful hydraulic dredger has recently arrived there to assist in the work.——The Great Indian Peninsula Railway Company is about to construct a large passenger station at Dadar, near Bombay.——A girder bridge is about to be erected over the Swat river at Chakdarah.——The Secretary of State has given his sanction for the construction of a bridge of thirteen spans of 150 ft. each over the Teesta river at Kaunia, on the northern section of the Eastern Bengal State railway.——The water taken from lakes for the supply of Bombay shows an increasing quantity of albuminoid ammonia; this is attributed to the growth of weeds in the water, especially in the Tausa lake. Nevertheless, the water as delivered to the public is stated to be of fairly good quality.——Competitive designs for the new Military Department buildings at Calcutta have been delivered in Simla, where they have been on exhibition in the Public Works Department. The new building is to be of considerable dimensions, and a special prize was offered for the selected design for the façade of the main entrance.

UNITED STATES.—It has been arranged to hold an art exhibition annually in Boston. The first was opened on the 20th inst. Only original works by contemporary American artists are to be admitted, and one of the features of the plan is that the exhibitors of each year are to select the jury for the following exhibition. Hitherto, European rather than American works of art have found favour in Boston, and the exhibition is intended to alter this state of affairs.——American architects are strongly protesting against the proposals to alter the White House, in Washington. The scheme of alteration has been chiefly drawn up by the Government engineer in charge of the executive mansion, in conjunction with Mrs. Harrison, wife of the ex-President of that name.

MISCELLANEOUS.

PROFESSIONAL AND BUSINESS ANNOUNCEMENTS.—The practice of the late Mr. Charles Henry Driver, architect, of 17, Victoria-street, is to be carried on by his eldest son, Mr. Charles H. Driver, in conjunction with Mr. Stanley Barrett, architect, who was for some time in Mr. Driver's office, under the style of "Barrett & Driver." The practice will be transferred to Mr. Barrett's office, 53, Blomfield-road, Maida Vale, W.——Mr. Joseph Hamblet, of the Eagle Engineering Works and Foundry, West Bromwich, has opened a London office at 110, Cannon-street, E.C.——Messrs. Young & Co., stable and cowhouse specialists, have removed their offices and showrooms from 12, Victoria-street to 161, Victoria-street, Westminster.

BRIDGE, ARDNAMURCHAN, N.B.—A new road-bridge over the River Shiel, at Ardnamurchan, has just been opened to traffic. The bridge is of stone, and is 150 feet in length. There are three spans, each of about 47 feet. The design was by Messrs. Blyth & Westland, Edinburgh.

SURVEYOR TO THE DULWICH ESTATES.—The Estates Governors of Dulwich College recently advertised for applications for the post of architect and surveyor for their estates. Out of a considerable number of candidates a selection was made by the Governors, and nine gentlemen were interviewed by them on November 15. From these nine, Messrs. Charles E. Barry, A. E. Pridmore, and G. Lister Sutcliffe were selected for a final interview on November 22. The ultimate choice lay between Mr. Barry and Mr. Sutcliffe, and the former was finally elected by, we are informed, a majority of one. Mr. Barry's father, the late Mr. Charles Barry, who died a few months ago, was the previous holder of the appointment.

ART UNION OF LONDON.—We have received from the Art Union a proof of the presentation etching to be issued to members of the Union for the current year. It is a large-sized etching of a landscape with water in the foreground, entitled "The Meadow Pool," and was commenced by Mr. David Law, who owing to illness was unable to complete it, and it has been completed by Mr. C. O. Murray. The plate is one of those large and highly-finished etchings for which Mr. Law is celebrated, and which we do not sympathise with, as they want the vigour and freedom of line which should be the special characteristic of etching; but it is a fine example of the class of work, which we presume is what best meets the taste of the majority of the subscribers.

AN ACETYLENE LAMP FOR INDUSTRIAL PURPOSES.—Messrs. Lockerbie & Wilkinson are manufacturing a new portable acetylene lamp for use on builders' works, railway works, and other places where a steady, brilliant illumination is required. The light intensity of the lamp is said to be about fifty candles, and it is stated that the cost of the light is only ¾d. per hour, and that the lamp will burn for eight hours without recharging. Unless this lamp gives a much higher light efficiency per cubic foot of acetylene than any burner yet placed on the market, we imagine that, in practice, the cost per hour for a fifty-candle flame will be found to be fully 1d.; but, even at this cost, there are many cases in which the lamp may with great advantage be employed. The brilliancy of the light should be greatly superior to that emitted by any ordinary oil lamp. The full title of the new lamp is "The Autolite Acetylene Industrial Lamp," and its price is 31s. 6d.

LONDON SCHOOL BOARD AND NEW SITES.—The School Board for London have issued their annual scheme of new sites which they propose to take under powers of the Education Acts, 1870-93, and, for the first time, of the Provisional Order Confirmation (London) Act, 1899. In terms of the latter statute they schedule some land and house property covering an area of about 16,700 ft. superficial for the erection of dwellings for the labouring classes on the site of twelve houses in Lowood, Dellow, and High streets, Shadwell. For additional public elementary schools and, in a few cases, the extension of existing school premises, they schedule a gross total of forty-one sites, but inasmuch as in each of three instances two alternative sites are named the net total amounts to thirty-eight, equivalent to an aggregate area of 50¼ acres, including one site of 14 a. 2 r. on the west side of the proposed Stainton-road, Catford, Lewisham. The school sites are situated in the following divisions: Chelsea.—Vineyard, Hurlingham-road, or Draycott Lodge, New King's-road; Nos. 71-81 (odd), Lillie-road; market garden ground in Crabtree-road; MacMurdo-road; and Studdridge-street, Fulham; Ellerslie-road, Hammersmith; Lot's-road, and Nos. 72, 72A, and 74, Park-walk, Chelsea. Finsbury.—No. 33, Dalmeny-avenue, Holloway; and No. 143, Hornsey-road. Greenwich.—Timbercroft, Greening, and Heavitree roads, adjoining the eastern boundary of the Kent Waterworks reservoir, Plumstead; Leahurst-road; Catford; Downhill, and Torridon roads, Lewisham; Grange Hill-road, and two sites in Glenesk-road, Eltham; Glenister-road, Greenwich, and No. 10, Mulgrave-place, Woolwich. Hackney.—No. 101, Mandeville-street, and Northwold-road. East Lambeth.—Nos. 59-71 (odd), Mina-road, St. Mary, Newington. West Lambeth.—Telferscot-road; and Bellamy-street (garden ground), Clapham; Elm Court House and gardens (90,930 ft. superficial), Lambeth; Greyhound-lane; Mitcham-lane; and Broadwater-road, Streatham; houses in Gwynne-, Yelverton-, and Urswicke-roads, St. Mary, Battersea. Southwark.—The Magdalen-street School, and several houses in Magdalen-street, Shand-street, and Gibbon's-rents, St. John, Horselydown. Tower Hamlets.—Sixteen houses, with forecourts and gardens, in Blakesley-street, St. George's-in-the-East; Nos. 29-40, Arbour-square, or nineteen houses in Bromley and Portland streets, Mile End Old Town. Marylebone.—No. 3, Park-place, gardens, Campbell-street, Paddington; eight houses in Barrow Hill-road, Primrose Hill; and either Nos. 3-7, Worsley-road, and the school house, also Nos. 12-15, Downshire-hill, with forecourts and gardens, or Nos. 5, 7, and 9, Well-walk, with lands, houses, gardens, &c., in Christchurch and Well roads, Hampstead. We may here mention that No. 5, Well-walk (Weatherall House), is the "Long Room" of the Wells, a favourite resort for its assemblies in the last century, when the avenue of limes in the walk formed the promenade. On the opposite side stood the pump-room—having been converted into a chapel and then into a volunteers' drill-hall, and pulled down about twenty years ago. The Walk, in which lived Keats, with his brothers George and Thomas, and Constable, has been widened and considerably altered of late years by the trustees of the charity endowed, 1698, by Susanna Noel, with six acres lying around the chalybeate spring.

PUBLIC IMPROVEMENTS, BRIGHTON.—Lieutenant-Colonel A. C. Smith, R.E., held an inquiry at the Brighton Town Hall on the 16th ult. into an application by the Corporation to borrow 35,701*l.* and 1,605*l.* for works of hard-wood paving, and 4,500*l.* for the purchase of land for purposes of street improvement, public baths, and a reading-room. Mr. Hugo Talbot, the Deputy Town Clerk, explained the application. The paving proposed to be put down was wholly of hard wood. The roads included were Grand-parade, Richmond-place, leading up to Elm-grove, Marlborough-place and Lewes-road, Beaconsfield-road and Church-street up to New-road. The loan of 4,500*l.*, also asked for, was for the purchase of a site in London-road known as Brighton Lodge. The Corporation thought it desirable to get the house to enable them to carry out an improvement, and also to provide a place for public baths, which would be carried on in lieu of the Brunswick-place Baths; also to enable the Council to provide a district newsroom. The 4,500*l.* was divided as follows:—Public baths, 2,830*l.*; street improvements, 560*l.*; newsrooms, 1,110*l.* Evidence was given by Mr. F. J. C. May, the Borough Surveyor.

NEWCASTLE AND DISTRICT BUILDING TRADES EXCHANGE.—The annual dinner of the Newcastle and Gateshead and District Building Trades' Exchange, Limited, was held at the Hotel Metropole, West Clayton-street, on the 23rd ult. Mr. J. G. Walker presided, and amongst the sixty present were Messrs. W. L. Newcombe (Vice-Chairman), C. B. Cawood (Secretary), and others. The loyal toast having been honoured, "The Architectural and Kindred Professions" was given by Mr. J. S. Robson. In doing so, he said the architectural profession was a most honourable and ancient one. It was one of the oldest in the world, and had handed down to posterity more of the history of mankind than any other profession. The civilisation and progress of a nation were measured by its architectural results. What a nation felt in religion and domestic life were expressed in the architecture of the time in which the edifices were raised. The architectural need of the nineteenth century was strictly utilitarian. When a noble profession had to deal with such varied styles of art they should render them the more credit for what they did do, and not criticise so much what they had not done. It must be remembered that they had their money-saving, fanciful clients to please.—Colonel F. R. N. Haswell, J.P., replied. The architect, he said, was nothing unless he had those who would carry out his intentions. Specially did he praise architects for what they had done for the longevity of the human race by inaugurating the sanitary provisions they had done. He also spoke hopefully of the skill of their young architects. Mr. J. P. Allen, who also responded, said they liked those meetings because they promoted the harmony that should exist amongst those in the building trades.—"The Building Trades"—the next toast—was proposed by Mr. G. G. Laidler. He said he regretted the heavy cloud that was hanging at present over the building trade, and he did hope that the offer that had been made by the builders for arbitration would be accepted. If it should not be, he was afraid that they would have an unfortunate time during the present winter. He spoke of the advantages of having a Building Trades Exchange and of organisation. In response, Mr. Stephen Easten spoke of the difficulties that the builder had to contend with, and said that the builders tried to be as fair and as straight as it was possible for them to be.—On behalf of the allied trades Mr. W. H. Allen also replied. He said they were all trying to bring about better methods in making people more comfortable and happier in their surroundings.—At this juncture a presentation to Mr. W. Sutton, junior, the late secretary of the Exchange, took place. Mr. Allen said that Mr. Sutton was a model secretary, and the success of the Exchange was greatly due to him. Lately Mr. Sutton had married, and the members had subscribed for the purchase of the black oak secretaire and chair they saw before them. It was no recompense for his services, but a very slight token of their esteem for him and his skill.—Mr. W. Sutton, junior, in reply, spoke of what the Exchange could do in the way of reforms and prophesied there was a future before it. The final toast was "The Exchange," which was given by Mr. R. H. Millican, and the replies were by Mr. J. G. Walker and the Secretary.

THE SPREAD OF SANITARY LITERATURE.—Professor Corfield's Harveian Lectures on "Disease and Defective House Sanitation," of which translations into French and Hungarian have already been published by the Royal Society of Public Health of Belgium and the Hungarian Society of Public Health respectively, have now been translated into Italian by Dr. Soffiantini, of Milan, and are being published, with the illustrations, in *Il Monitore Tecnico*, the leading engineering and architectural journal of that city.

GLASGOW ARCHITECTURAL CRAFTSMEN'S SOCIETY.—The fourth meeting of the session was held on Friday evening, 23rd ult., when a paper entitled the "Duties of a Clerk of Works" was read by Mr. Wm. A. Muir. In the course of his remarks the lecturer strongly recommended the regular reporting to the architect each week on the progress of the work by means of written statements framed on lines such as these: number of men in respective trades employed each day, with number of hours of each; state of weather and amount of work accomplished each day; drawings received and drawings required. The taking of notes of extras or modifications on the work was also considered to be essential, these being of great assistance at completion in the checking of accounts, &c. A discussion on the subject was opened by Mr. J. Fairweather, and continued by other speakers.

TRINIDAD TIMBER AND ASPHALT.—Timber to the value of 10,224*l.* was exported from Trinidad last year, the proportion sent to Great Britain being of the value of 2,463*l.* Of asphalt, 13,429 tons were exported to Great Britain and 109 tons to Canada.

Reporting on these products, Mr. Bourne, the acting Colonial Secretary, observes: "There is much fine timber on the Crown lands of Trinidad, but under the long-needed system of forestry which is about to be introduced, felling will be chiefly restricted to the satisfaction of local demands for many years to come. There are, however, ornamental woods for which a demand might be created if they were judiciously placed on the English timber market. Of the mineral products of the colony, asphalt is, as is well known, by far the most important. The asphalt trade was more prosperous in 1899 than in any previous year of its history; 140,000 tons were exported—99,000 to the United States—representing a value of 150,000*l.* and a revenue to the Crown of 45,000*l.* Reliance, however, cannot be placed on the continuation of the business on this scale. Seven-eighths of the asphalt exported is dug from the Pitch Lake, which is leased to a company for a term, of which twenty-nine years have still to run, and the company are bound to ship as much as one-third of last year's output. In view of the fact that a similar lake at Bermudez, in Venezuela, ten times its size, and containing asphalt purer in the proportion of 97 to 56, is already being worked, Trinidad can no longer claim to command the asphalt market. The demand for asphalt is, however, growing, and there are greater difficulties in shipping it from Bermudez than from Trinidad. Pitch in a liquid form mixed with a bituminous oil is also to be found in the south of Trinidad, and coal exists in various parts of the island. The commercial value of these deposits has, however, not yet been satisfactorily tried."

REFUSE DESTRUCTOR, MOSS SIDE, MANCHESTER.—A Local Government Board inquiry into an application by the Moss Side Urban District Council for permission to borrow 10,870*l.* for the construction of a refuse destructor was held in the Free Library, Moss Side, on the 20th ult. The inquiry was conducted by Mr. W. O. E. Meade-King. The site for the proposed destructor is to the east of Beresford-street. Two-thirds of the site, it was explained, would be used for the destructor; on the remainder it was proposed to erect public baths. The scheme was described by Mr. H. B. Longley, the engineer and surveyor to the District Council. It has met with considerable opposition.

PUBLIC IMPROVEMENTS, &C., DUBLIN.—On the 22nd ult. Mr. P. C. Cowan, Chief Engineering Inspector to the Local Government Board, held an inquiry in the City Hall, Dublin, with reference to the application of the County Borough Council for sanction to the following loans:—(1) 10,400*l.*, supplemental loan for electric lighting; (2) 800*l.* for sewerage works in Prussia-street and Aughrim-street; (3) 9,884*l.* 4s 4d. for paving, asphalting, sewerage works, &c, in connexion with the Bull-alley area scheme; (4) 810*l.* for private improvement works; (5) 8,658*l.* for asphalting, wood-paving, concreting, and the purchase of steam road-rollers; (6) 3,000*l.* as loans under the Small Dwellings Acquisition Act. Mr. Campbell, Town Clerk, and Mr. Ruddle, Electrical Engineer, gave evidence as to the necessity for the loans. Mr. Harty, C.E., also gave evidence.

ELECTRIC LIGHT, WILLESDEN.—At a meeting of the Willesden District Council, on Tuesday night, it was reported that the Engineer had received the bills of quantities in connexion with the main and sub-electricity stations. The Council decided to apply to the Local Government Board for sanction to a loan of 52,550*l.* for use as follows:—Buildings, walls, sites, works, chimney shaft (main station), 36,104*l.*; tenants' compensation, 121*l.*; cost of road, 325*l.*; coal sidings, 2,500*l.*; offices and sub-station, 13,500*l.*

ELECTRIC LIGHT, KENSINGTON WORKHOUSE.—At the last meeting of the Kensington Board of Guardians a Report came up from the Special Electric Lighting Committee. They were unanimously of opinion that it was desirable to light the workhouse, infirmary, and office buildings in Marloes-road by electricity. The Board decided to instruct Professor Robinson to prepare and submit a complete plan and specification for the buildings, machinery, and plant required, at an estimated cost of 12,500*l.*

CAPITAL AND LABOUR.

PENRHYN QUARRIES. — The deadlock at these quarries continues, and numbers of the men are seeking work in other districts. The Chief Manager was interviewed by representatives of the Press, when the question of sub-contracting was discussed. There seems to be no valid reason why the system in force in other quarries of making the men partners, and the quarry providing means of traction, should not be adopted here.

STRIKE OF DUBLIN PLUMBERS.—A strike affecting several Dublin establishments and about 300 plumbers has been entered on in the city, arising out of a demand by the men for an increase of 1d. per hour in the wages they have hitherto been receiving.

THE BUILDING TRADE DISPUTE IN NEWCASTLE AND DISTRICT.—Owing to the decision of the men in Newcastle and Gateshead to reject the proposal of the employers, the practical lock-out of all bricklayers in the Northern Counties began to take effect from mid-day on Saturday last. The Northern Counties embrace Northumberland, Durham, part of Cumberland, and part of Yorkshire, including the important town of Leeds. The total number affected, says the *Newcastle Chronicle*, will be several thousands, and this will be greatly increased in the course of a very short time, owing to other trades engaged in building operations being brought to a standstill by the cessation of work by the bricklayers. The dispute originally started in Newcastle, when the men, to the number of 128, belonging to three branches of their union, known as Newcastle, Gateshead, and Byker lodges, in the early part of the year put in an application for an advance of wages, from 10d. to 11d. per hour. The employers intimated that the trade in this northern district would not allow of such application being granted. In order, however, to avert a strike or lock-out, the employers added that they would be quite willing to submit the claim to arbitration, or to give a guarantee to allow the present rate of wages to continue for the next two years. To this the men gave a refusal, contending that the state of trade, as evidenced in the erection of a large number of houses, justified them in asking for the advance. On the other hand, the employers considered that this was but the beginning of other things, that if the application were granted, similar demands would be made in other parts of the northern counties. Then other trades actively identified in building operations would in all likelihood put in demands for an advance of wages. Thus, it was contended, the employers would be seriously handicapped in carrying out their contracts, and it was deemed advisable to take counsel with the Building Trades Employers' Federation, and after several meetings, it was decided that if the proposals put forth by the Newcastle and Gateshead employers were not complied with by the bricklayers on November 21, a lock-out should ensue. In compliance with a request, the notice was extended until the 24th, and in the meantime, the General Secretary of the men's Federation (Mr. Bachelor) and other officials had an interview with the employers, but no definite arrangement was come to. The men's representatives, in reply to inquiries, state that out of the 128 men who came out on June 2, there are only about fifty now on the books, the rest having obtained employment elsewhere. The men who are not at work receive an allowance of 1*l.* per week—15s. each Friday night, and on the following Tuesday an additional 5s. from the levy made amongst the men in employment. Thus 15s. is taken out of the funds of the society, the balance being made up by weekly contributions. According to the constitution of the society, no distinction is made between the married and the single men, each receiving the sum named. Asked whether it was thought this allowance would be extended to all the men thrown out of work in the northern counties, a reply was given to the effect, that there is a large reserve fund in hand, and that this contingency had been well looked to before any definite step was taken. Despite the action of the employers in bringing a general lock-out, the men expressed themselves hopeful of ultimate success.—The *Chronicle's* Sunderland reporter writes:—In accordance with the resolution passed on November 23 at the meeting of the Sunderland builders, notices were issued on the 24th ordering a lock-out of bricklayers. The notices took effect at noon. The relations between the masters and men locally are of the best, and the masters, though regretting the step, feel that it is absolutely necessary in their own interests. The number of bricklayers in Sunderland is about 300, but with the labourers and others it is estimated that some 600 men will be affected immediately. The house building trade in Sunderland is exceedingly brisk just now, and the stoppage will be felt severely. The joiners will not be impeded for some time as the joinering work is a long way behind, there being sufficient in hand to keep the men going for a few weeks.—With reference to the lockout, so far as Middlesbrough is concerned, the master builders as yet have taken no action; but, if an amicable settlement is not speedily arrived at, the employers feel that they will have to join the movement. The master builders of Yorkshire, Lancashire, and Cheshire have decided to support those of Northumberland, Durham, Cumberland, and Westmoreland in their dispute with the bricklayers.—An important meeting under the auspices of the Yorkshire Building Trades Federation, was held in Leeds on Saturday last, for the purpose of formulating a Northern Counties Federation of Building Trades. Delegates attended from Manchester, Oldham, Blackburn, Hull, Barnsley, Halifax, Sheffield, Harrogate, and Bradford. Rules were adopted for the government of the Federation, and officers elected. Mr. Edwin Grist (Manchester) being chosen President, Mr. A. H. Driver (Sheffield) secretary, and Mr. T. C. Heal (Leeds), treasurer. The objects of the Federation are set forth as of a defensive character, and efforts are to be made to educate and organise workers in all branches of the building trade, and to assist in the formation of branches where none exist. The Federation anticipate in the near future, by holding conference with the employers, and by other conciliatory means, to settle the vexed questions between capital and labour without resorting to strikes or locks-out. Meetings have been previously held to discuss the details of the scheme, and it is stated that the Northern Counties Federation having now been firmly established, efforts will be made to extend the organisation over the rest of the country.

LEGAL.

STRANGE MISTAKE BY A BUILDING OWNER.

THE case of Butler *v.* Kennis and others, came before Mr. Justice Phillimore and a common jury in the Queen's Bench Division on the 21st ult., it being an action by the plaintiff to recover possession of two plots of land with houses upon them at West Ham, Essex. The facts were shortly these:—In September, 1897, two plots of land marked on the estate plan Nos. 172 and 173 were conveyed to the plaintiff. A person named Bethel owned the adjoining plots Nos. 170 and 171, and in 1898 he entered into agreement with a builder named Murty to build two houses upon them. Bethel pointed out to Murty the plots to be built upon but by some mistake the plots 172 and 173 were taken instead of plots 170 and 171. Murty built upon the plots 172 and 173 the houses, which cost about 200*l.* each. While in the course of construction the defendant bought the houses for 500*l.*, paying 100*l.* down, the balance of 400*l.* being afterwards obtained from a building society on a mortgage of the houses. The plaintiff's case was, that the first time his attention was called to the fact that the houses were built on his land was in April last, and he then laid claim to their possession. The defendant offered to give the plaintiff his two plots and also 200*l.* as compensation, but this was refused. The plaintiff was called, and gave evidence to the effect that he first knew that the houses had been built on his land in April last, and that was some time after the houses had been erected. On the other hand the defendant, Murty, the builder, and his foreman, were called to prove that the plaintiff had been on the premises while the houses were in course of erection and that he made no complaint.

His Lordship, in summing up, said the defence that the plaintiff stood by and knowingly allowed the houses to be built on his land was good if proved, but the burden was upon the defendant to prove that, because it meant that the plaintiff had been guilty of fraud. If the verdict was for the plaintiff, he did not think the defendant would lose his money, as he would have a good right of action against Bethel, and the building society would have a right of action against their solicitors.

In the result the jury found a verdict for the plaintiff, and judgment was given in accordance with the verdict, the question of costs being reserved.

On the 28th ult. the matter was again mentioned to Mr. Justice Phillimore.

Mr. Macaskie, for the plaintiff, said he was glad to be able to tell his Lordship that the parties had been able to arrive at a settlement, and he (counsel) would take judgment by consent for the plaintiff on terms, and execution was not to issue if certain things were done by the defendants. The learned counsel stated that the settlement arrived at substantially amounted to this, viz., that the plaintiff took part of the value of the houses and the defendants the other part. He understood that his learned friend Mr. Lush, on behalf of the defendants, withdrew entirely the charge of fraud which had been made.

Mr. Montague Lush said that that was so.

Mr. Justice Phillimore, in assenting to the arrangement, said he was glad that the parties had been able to come to terms.

A DISTRICT SURVEYOR AND HIS FEES.

AT Greenwich Police-court, Mr. Kennedy gave judgment in the case against Mr. Alexander Cameron Corbett, M.P., who had been summoned by Mr. Badger, District Surveyor, to recover fees, amounting in all to 54*l.*, in respect of the erection of houses on Corbett's Estate, Hither Green, Lewisham.

Mr. Barnard appeared for the District Surveyor, and Mr. Bethune for the defence.

The defence was that the builder, and not the defendant, was liable; also that the defendant was not actually the owner, and that the six months allowed for making the demand had expired.

Mr. Kennedy said that quiet reflection had led him to the conclusion that the fact that the defendant had already paid the builder was not enough to deprive the District Surveyor of his fees. The defendant would have to settle that with the builder. The owner at the time the fees became due was the person liable, and he gave judgment for the complainant with 12 guineas costs.

BUILDING BY-LAWS AT BIRKENHEAD

DOUGLAS LUTHER CLELAND, builder, New Chester-road, Rock Ferry, was summoned at the Birkenhead Police-court, on the 23rd ult., before the Mayor (Alderman Thomas Cook) and Mr. Edward Williams, for infringements of the Corporation building by-laws in connexion with a

workshop erected off New Chester-road. Mr. Spencer, assisting prosecuting solicitor, conducted the prosecution, and Mr. Cotton defended. Mr. Spencer stated that, the defendant having been previously convicted for offences against the by-laws in connexion with the same erection, the Corporation had given him notice that he would be proceeded against also for continuing each offence. Evidence was then given that the plans were passed by the Corporation in February, but on July 15 a Corporation building inspector found a number of defects in the erection. The magistrates inflicted fines and costs, the total amount of the penalties and costs being 14*l.* 19*s.* Defendant pleaded that the shed was now being altered in accordance with the by-laws, but the magistrates alluded to concessions which had been made to the defendant by the Corporation long ago, and said the defence was unsatisfactory. The Mayor said that if every man was allowed such concessions as had been granted to the defendant, the Borough Engineer's staff would have to be doubled. The offences and penalties were—(1) having erected, on July 18, a building of the warehouse class, used as a joiner's workshop and storeroom, with an external wall of 4½ in. thickness instead of a minimum of 14 in., 1*l.* and 6*s.* 6*d.* costs; (2) continuing the said offence from July 21 to November 16, 100 days at 1*s.* a day, 5*l.* and 6*s.* 6*d.* costs; (3) not providing outlets to untrapped openings to the drain, on October 1, 1*l.* and 6*s.* 6*d.* costs; (4) continuing the offence from October 3 to November 16, thirty-five days at 2*s.* a day, 3*l.* 10*s.*, and 6*s.* 6*d.* costs; (5) continuing the infringement of not resting the walls on proper footings (for which defendant had been previously convicted), from July 21 to November 16, 100 days at 3*d.* a day, 1*l.* 5*s.*, and 6*s.* 6*d.* costs; (6) for continuing the offence of not causing the walls to have a proper damp course (for which defendant had previously been convicted) from July 21 to November 16, 100 days at 3*d.* a day, 1*l.* 5*s.*, and 6*s.* 6*d.* costs.—*Liverpool Mercury.*

THE WORKMEN'S COMPENSATION ACT:

ANOTHER ANOMALOUS CASE.

AT the Gloucester County Court last week, his Honour Judge Ellicott delivered his award in the case of Maria Dredge, Painswick, Gloucestershire, *v.* Conway, Jones, & Co. (painters and decorators, Gloucester). This was a claim under the Workmen's Compensation Act for 254*l.* for the death of applicant's husband, a foreman plasterer. From the evidence it appeared that deceased and another man were whitewashing and stopping the cracks of a staircase ceiling in Gloucester, when the scaffolding (consisting of an arrangement of ladders and planks) on which they were at work fell, and the men were precipitated a distance of some 30 or 35 ft. to the lobby beneath. Dredge was killed by the fall, and his fellow-workman much injured. Mr. Arthur Powell, who represented the respondents (virtually the insurance company), for the defence said that the case turned on the few words of Section 7 of the Act—"A building which is either being constructed or repaired by means of a scaffolding." It could not be contended, said Mr. Powell, that the building on which the deceased was at work was either being "constructed" or "repaired," because it was quite clear that decorative work—such as whitewashing ceilings and distempering walls—was not repairing. Counsel further argued that the erection used for doing the work was not scaffolding within the meaning of the Act. His Honour held that the ladders and planks used constituted a scaffolding within the meaning of the Act, but found that the work upon which deceased was engaged at the time of the accident was not structural repairs within the meaning of Section 7 of the Act. The case therefore failed upon that point, and although it was only natural that one's sympathy should be with the applicant, the award must of necessity be for the respondents. Leave was given to appeal.

ACTION AGAINST MESSRS. MOWLEM.

IN the Westminster County Court on Monday, before his Honour Judge Lumley Smith, Q.C., and a jury, the case of Walker *v.* Mowlem was tried.

It was an action by the plaintiff to recover compensation from the defendants, the well-known firm of contractors, for personal injuries sustained owing to the alleged defective condition of their plant.

The plaintiff's case was that on the day of the accident she was passing along James-street, Brighton, where the defendant's firm were carrying on some excavations, and owing to the insufficient way in which the cutting was protected she fell into the hole and suffered very severe personal injuries.

The plaintiff was called and said the hole into which she fell was protected by ropes attached to iron standards, but they were so loose that they did not afford any protection.

In cross-examination the witness said her injuries were very severe, and that was why there was delay in putting this claim forward.

The defence was that the work was properly protected in every way and that the accident was the result of the plaintiff's negligence, pure and simple.

His Honour in directing the jury, said that in order to find a verdict for the plaintiff they would have to satisfy themselves that the defendants' works were defective, and also that the plaintiff had not been guilty of contributory negligence.

The jury, without any hesitation, found a verdict in favour of the defendant firm, and judgment was entered with costs.

RECENT PATENTS:

ABSTRACTS OF PATENTED INVENTIONS.

15,310.—VARNISHES: *A. P. Bjerregaard.*—Unboiled linseed or some similar fatty oil is mixed with a copal gum or amber, finely ground, and is heated until the gum becomes melted; turpentine, &c., is then added for thinning, and a drier, such as precipitated manganese borate and litharge, is stirred with the compound. By another process cold gum is gradually added to the oil as the latter is being heated; the admixture is then further heated, stirred, and tested.

15,331.—GUIDE ROPES FOR COLLIERY CAGES, &C.: *B. F. Cocker.*—At the end of each guide rope is secured a bolt that passes through a cap, which is supported upon two springs within a cup, so that injury to the spring is obviated by the resting of the cap upon the cup when the tension becomes excessive, the initial slack being taken up by distancing bolts that sustain the cap.

15,340.—LEVELS AND CLINOMETERS: *E. O. Wiltsch.*—Two parallel blades that are joined by small bars pivoted on to a blade compose a straight-edge. Upon the blade are mounted two spirit-levels that are set at a right angle to one another. A screw-bolt, that passes through slotted and graduated arms, and a nut serve for clamping the straight-edge at the angle required. In order to test whether an arris forms a true angle of 90 deg., the two parallel blades of the straight-edge are turned outwards at an angle of 45 deg., and the bars are notched in line with the bent portions of the outturned blades.

15,346.—SNOW PLOUGHS: *J. G. Weniger.*—In front of the carriage are mounted a pair of scoop-wheels which will be driven in reversed directions by means of spur gearing, or in the same direction with sprocket gearing, from a motor. The blades upon each of the scooping wheels are cone-shaped at the front ends and cylinder-shaped at their rear ends as attached to the disc, and they are set tangent-wise with the axle.

15,387.—NON-CONDUCTING COMPOSITIONS: *J. McLay.*—Heat-insulating coverings for pipes, vessels, &c., are composed of asbestos in the form of papier-maché or vegetable substances rendered incombustible, and are shaped in a mould which contains a mandrel and a loose core or sleeve by means of a piston which is worked with a screw or other mechanism.

15,388.—PIPE-JOINTS, PACKING AND STOPPING: *W. Morley and P. W. Barker.*—For the jointing of pipes or mains the inventors devise a shaft and hand-wheel for screwing together or opening out two discs, between which is placed an india-rubber or similar ring. The ring will become expanded or contracted accordingly, whilst its turning round is prevented by a rod and a tail-piece. In order that the contrivance may be duly centred, it is fitted with a roller at its one end and at its other end with a gauge-piece having pegs that rest upon the walls of the pipe; thus the rod and shaft are furnished with bearings. In modified forms one of the discs is stationary, and the central rod is made hollow for the admission of compressed air to the chamber formed by the india-rubber ring, the air's escape being regulated by a spring-governed valve worked by the side-rod. For purposes of stopping the outer ends of the branch side-openings of the pipes, the ringed space is filled with clay, &c., so as to fix the customary stop-piece in its place, over the stopper is placed a metal mould which forms a ringed cavity, and the binding material constitutes an annular flange. The binding material consists of coal tar and sulphur mixed with sawdust, sand, &c.

15,391.—A DOOR-HANDLE: *A. Jones.*—For opening the latch by squeezing the handle the inventor provides small tubes that are pivoted at their lower ends to the two handles; a squeezing of the handle forces the tube into a recess therein so as to compress a spring; a cross-bar which joins the tubes has an inclined face which operates upon the spring latch's roller.

15,405.—WINDOW-FASTENINGS.—*D. M'Kinnon.*—For fastening a sliding window-sash at any particular height (as may be desired in an asylum), a spring forces a hooked catch, which is pivoted on to a slotted plate in a recess cut in the pulley-stile, into engagement with the ratchet teeth of a rack which is secured to the sash-stile, a similar contrivance, but with the ratchet teeth turned in the opposite direction, being fitted on to the lower sash. When the sashes are to be freed, a key is used to unlock a part of the inside bead or batten rod, whereupon cranked spindles linked together and moved by a handle upon the lower spindle will force the catch backwards. By another adaptation the catch is mounted upon the sash and the rack is fastened to the pulley-stile, the catch being put back out of action with a key to be inserted through a keyhole in the sash-stile, which may be covered with a detachable portion of the inside bead.

15,422.—A FEEDING-RACK AND TROUGH: *J. D. T. H. de Burgh.*—The rack or trough can be fitted by any one without entering into the shed or stable. Its back is composed of wire-work or wire-netting with strips, and its front of bars; the back and an outer part constructed of sheet metal form a passage which leads into the trough, and is closed (together with the top of the rack) with a hinged cover. The contrivance, which also provides for a water compartment in the trough, will, it is claimed, serve to improve the ventilation of the stable.

15,429.—SLEEVE AND FLANGE PIPE-JOINTS: *A. E. Dart and H. S. Crombie.*—The sleeves are fashioned so as to have convex and concave ends that will fit together as in the case of a ball-and-socket joint, and a packing-ring, curved to correspond, is fitted into a recess made in one of the sleeves, thus the two pipes can be moved out of alignment; or one sleeve may be flanged and be bolted on to a loose flange which is to be passed over the other sleeve so that it shall fit against the curved flange. Packing-rings, which ought to be made of lead for pipes containing corrosive liquids, can be fitted into the ends of both the sleeves.

15,436.—A BALL-AND-FLOAT VALVE: *H. G. Bedell and J. Welsby.*—For purposes of ready removal the body of the casing of the supply valve for the cistern is screwed on to the cap, the valve's stem being set within guides, and its lower part being in engagement with the float lever. The valve may be adapted to open either against or with the water's pressure, and water, for purposes of a cushion, is collected within a small container. In the case of a valve after the latter kind the extent of its fall is limited with a lug or projection upon the float lever, and that of its opening by means of a boss upon the stem.

15,533.—BUILDING TILES: *W. Carturight.*—Rounded corner-tiles or angle-beads are fashioned with inner edges which project and interlock with the cement upon the face of the wall, and are thicker than the facing-tiles. The tiles are also made with projections or dovetailed ribs, and with grooves that will take ribs of the same or some other material.

15,558.—ROOFING TILES: *L. Becker.*—The inventor's purpose is to afford means for ventilation; and for enabling the water that arises from condensation to find an escape from beneath the tiles, he fashions the tiles with collecting channels, which are arranged transversely in their upper ends, and joins them to the tiles' outer channels by drainage holes.

15,600.—DOOR HINGES: *F. Liedgens.*—The hinge, which will enable the door to become closed through its own weight, is formed out of two flaps, to one of which is fixed a pin upon which slides the socket of the other flap. Two rings, whose sloped surfaces touch one another, are placed between the two sockets, and each of them is detachably joined to its own socket with teeth that enter into recesses cut in the socket. The door's weight pressing upon the rings causes it to turn from either side into the closed position.

15,619.—LIFT VALVES: *E. Ziegler.*—The inventor seeks to furnish easy means for cleaning and repairing the tap. He arranges within the tap an india-rubber or other kind of ball so that it shall, under normal conditions, be forced away from the seating by a spigot at the lower end of the lift valve; when, however, the lift valve is raised, the flow of water will press the ball upon its seating, and so close the valve.

15,637.—A SEATING FOR A SCREW-DOWN VALVE: *J. Cockbill, E. Chamberlin, and C. Chamberlin.*—For a screw-down valve the seat is screwed into the valve casing, in order that when it has become worn it may be easily taken out; and to admit of the insertion of a key for screwing or unscrewing the seat, notches are formed in the seat's upper and larger portion.

15,640.—AN ARTIFICIAL STONE.—*F. Gernaert and C. Libert.*—The stone is manufactured by treating with steam under pressure a mixture of crushed sand, lime, and the customary materials, the crushed sand being substituted, either in whole or in part, for the common sand, and being in some instances itself replaced with sand that has been "burst" in ice water after exposure to a high temperature. The inventors claim that the sand thus treated will combine more intimately with the lime, and that the artificial stone will be frost-proof.

15,659.—KILNS FOR BURNING SEWER PIPES AND SIMILAR CLAY GOODS: *J. T. Finch.*—The roofs of the kilns are dome-shaped and are constructed double so as to provide an additional chamber for the flow of the gases from the one kiln in which the burning has been completed into the other kiln where the burning is not yet finished. Openings, to be closed with removable covers, are made in the two double roofs of each kiln, and pipes—having pierced extensions, and fitted with dampers—communicate between the additional chambers of the several kilns. For each kiln chamber are provided flues, with their dampers beneath the floor, which pass to the chimney. When direct draught to the chimney has served to burn the goods in any one chamber the damper of that kiln is closed, the gases will thereupon be allowed to escape into another chamber through the openings in the lower roof, which have

been uncovered in readiness, and through the dampers of the connecting pipes. During the process of drying, steam will escape by pipes set through the roof.

15,804.—ENAMELLING FOR BRICKS, &c.: *E. P. C. Willems.*—An enamelling compound is made by melting together silica (about 36 parts), an alkaline matter (7 parts), alumina (10 parts), with 47 parts of oxide of cobalt, oxide of tin, oxide of iron, or other metallic oxides for giving colour to the compound.

15,814.—A LIFTING-JACK: *A. L. Marcotte and M. A. Legros.*—The jack is made of two cylinders which are oppositely screw-threaded within, and which are in engagement with a corresponding screw. A pawl and ratchet, to be worked with a lever by the hand, turn the screw for purposes of both raising and lowering, while the screw is driven in opposed directions with two spring-pawls.

MEETINGS.

FRIDAY, NOVEMBER 30.

Architectural Association (*Discussion Section*).—Paper by Mr. F. G. W. Buss, entitled, "Is the Quantity Surveyor a Necessity?" 7 p.m.

Institution of Junior Engineers (*Westminster Palace Hotel*).—Inaugural meeting of twentieth session. Sir Lowthian Bell, Bart., will deliver his presidential address. 8 p.m.

Architectural Association of Ireland (*Technical Demonstrations*:—*II.*).—Messrs. Edmund and A. P. Sharpe on "Building and Decorative Stones." 4.30 p.m., at 17, Great Brunswick-street.

SATURDAY, DECEMBER 1.

Sanitary Inspectors' Association.—Mr. F. W. Morley on "Overcrowding in Domestic Dwellings." 6 p.m.

British Institute of Certified Carpenters.—Annual Meeting, Carpenters' Hall. 6 p.m.

Dundee Institute of Architecture.—Mr. J. J. Henderson on "Grammar of House-planning." 7 p.m.

MONDAY, DECEMBER 3.

Royal Institute of British Architects.—Business meeting.—(1) Election of candidates for membership. (2) The Chairman to move the adoption of amendments to the "form of agreement and schedule of conditions for Building Contracts," as agreed upon by the Council of the Royal Institute and the Council of the Institute of Builders. 8 p.m.

Society of Engineers. — Mr. H. C. H. Shenton on "Recent Practice in Sewage Disposal." 7.30 p.m.

Liverpool Architectural Society.—Mr. Alfred Darbyshire, F.S.A., on "Some English Cathedrals." Illustrated by lantern slides. 6 p.m.

TUESDAY, DECEMBER 4.

Society of Arts (*Cantor Lectures*).—Professor J. A. Fleming, F.R.S., on "Electric Oscillations and Electric Waves." II. 8 p.m.

Institution of Civil Engineers.—1. Discussion on Mr. Oscar Guttmann's paper on "Machinery for the Manufacture of Smokeless Powder." 2. Papers to be read, time permitting:—(*a*) "The Signalling on the Waterloo and City Railway"; and (*b*) "Note on the Signalling of Outlying Siding Connexions, by Mr. Alfred Weeks Szlumper; and (*c*) "Signalling on the Liverpool Overhead Railway," by Mr. S. Butler Cottrell. 8 p.m.

WEDNESDAY, DECEMBER 5.

Royal Archæological Institute of Great Britain and Ireland.—1. Rev. Dr. Cox on "Northamptonshire Wills, *temp.* Henry VIII." 2. Mr. P. M. Johnston on "Wall Paintings, &c., at Hardham Church, Sussex, and at St. Mary's, Guildford." 4 p.m.

British Archæological Association. — Mr. T. Cann Hughes, M.A., on "A Ramble in South Devon." 8 p.m.

Society of Arts.—Professor H. S. Hele-Shaw on "Road Traction." 8 p.m.

Builders' Foremen and Clerks of Works' Institution.—Ordinary meeting of the members. 8 p.m.

Institute of Sanitary Engineers.—General Purposes and Finance Committee at 3.30 p.m. Election Committee at 5 p.m.

Edinburgh Architectural Society.—Mr. T. Hume on "Effects of Heat and Cold on Plumber Work, and How to Prevent Damage Therefrom."

THURSDAY, DECEMBER 6.

Civil and Mechanical Engineers' Society.—Professor R. H. Smith on "Valve Gears and Valve Diagrams." 8 p.m.

FRIDAY, DECEMBER 7.

Architectural Association.—Mr. A. Wallace Rimington on "Colour in Architecture seen through an Artist's Glasses." 7.30 p.m.

Institution of Civil Engineers (*Students' Meeting*).—Mr. F. K. Peach on "Dock Gates." 8 p.m.

Architectural Association of Ireland (*Technical Demonstrations.* III.).—Messrs. Alston and Hudman on "Timber." 2 p.m., at 29, Rogerson's Quay.

Glasgow Architectural Craftsmen's Society.—Mr. T. S. Fraser on "Some Principles of Design." 8 p.m.

SATURDAY, DECEMBER 8.

British Association of Waterworks Engineers.—Half-yearly Meeting at the Geological Society's Rooms, Burlington House, W. Presentation of Report from the "Water Boards" Committee on "The Control of Water Undertakings and Sources of Water Supply," and discussion. A paper will be subsequently read, entitled "The Protection of Underground Water," by Mr. Wm. Matthews, M.Inst.C.E. 11 a.m.

Institution of Junior Engineers.—Visit to the Electric Generating Station of the London United Tramways Company, 88, High-road, Chiswick. 3 p.m.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

November 14.—By FRANKLIN & SON (at White Roothing).

White Roothing, Essex.—Prow's, Manning's, and Nash's Farm, 210 a. 0 r. 1 p., f. and c.	£1,450
Blatch's Tenements and 1 a. 2 r. 21 p., f.	330
Various enclosures of land, 41 a. 0 r. 10 p., f.	682
House and blacksmith's shop, f.	£130
Six freehold cottages and tenements	425

November 15.—By HOOKER & WEBB (at Croydon).

Croydon.—Pemdevon-rd., thirteen plots of land, f.	858
Thornton Heath.—72 and 74, Bensham Manor-rd., u.t. 93 yrs., g.r. 16*l.*, r. 80*l.*	685

November 19.—By MONTAGU & ROBINSON.

City of London.—26, Walbrook, f., r. 350*l.*	8,700
14, Clement's-lane, u.t. 14½ yrs., g.r. 90*l.*, r. 350*l.*	1,650
Holborn-circus.—20, Thavies Inn, f.	2,500
Caledonian-rd.—Frederick-st., i.g.r. 54*l.*, u.t. 51 yrs., g.r. 4*l.*	850
Blundell-st., i.g.r. 105*l.*, u.t. 51 yrs., g.r. 5*l.*	1,480

By BEALE & CAPPS.

Notting Hill.—18, Bassett-rd., u.t. 74½ yrs., g.r. 10*l.*, e.r. 100*l.*	800

By FRED. VARLEY.

Finsbury Park.—323, Seven Sisters-rd., u.t. 64 yrs., g.r. 19*l.*, e.r. 150*l.*	2,000
16, Lennox-rd., u.t. 64 yrs., g.r. 5*l.*, r. 30*l.*	335

By FERRIS & PUCKRIDGE (at Swindon).

Little Hinton, Wilts.—The Grove and 31 a. 0 r. 28 p. f.	1,580

By HENRY HENDRIKS (at Birmingham).

Small Heath, Worcester.—108 and 109, Yardley-rd. f.	660
Edgbaston, Warwick.—148 and 150, City-rd., u.t. 98 yrs., g.r. 12*l.*	880
Handsworth, Staffs.—30 and 32, Linwood-rd., u.t. 85 yrs., g.r. 7*l.* 8*s.* 9*d.*	600
38 and 40, Montague-rd., u.t. 94 yrs., g.r. 9*l.* 7*s.*	855

By J. GLEW (at Selby).

South Duffield, Yorks.—A freehold farm, 100 acres	2,450
Low Common allotment, 6 a. 2 r. 11 p., f.	200
North Duffield, Yorks.—Hill Rows Close, 9 a. 3 r. 10 p., f.	560

November 20.—By DANIEL WATNEY & SONS.

Tottenham Court-rd.—5, 7 and 9, Charlotte-st., f., r. 150*l.*	4,050
11 and 13, Charlotte-st., area 1,850 ft., f., r. 175*l.*	4,400
40 and 41, Upper Rathbone-pl., f., r. 72*l.*	2,030

By DAVID BURNETT & CO.

Chelsea.—2 and 6, Bywater-st., u.t. 8 yrs., g.r. 10*l.* 10*s.*, r. 68*l.*	140

By HATCH & HATCH.

Catford.—40 to 50 (even), Laleham-rd., u.t. 74 yrs., g.r. 28*l.* 7*s.* (subject to mortgage of 1,200*l.*)	3,000

By HOLCOMBE, BETTS, & WEST.

St. John's Wood.—69, Hamilton-ter., u.t. 35¼ yrs., g.r. 14*l.* 6*s.*	1,900
Hammersmith.—10 and 12, Augustus-rd., u.t. 63 yrs., g.r. 4*l.*, r. 64*l.*	810
Caledonian-rd.—84, 86, and 88, Brewery-rd., u.t. 59 yrs., g.r. 14*l.* 10*s.*, r. 55*l.*	585
Shepherd's Bush.—26, Aldine-st., f., e.r. 50*l.*	850
Bulwer-st., Cyprus Villa, f.	700

By HUMBERT & FLINT (at Watford).

Bushey, Herts.—London-rd., Risingholme and 3 acres, f.	1,975
Abbotts Langley, Herts.—15 and 17, Langley-rd., f.	505

By WHETHERLY & HASLETT (at Masons' Hall Tavern).

Lewisham.—High-st., the White Hart p.h., u.t. 42 yrs., r. 150*l.*, with goodwill	10,000

November 21.—By BRIANT & SON.

Leytonstone.—33 to 45 (odd), Wellesley-rd., u.t. 69 yrs., g.r. 40*l.* 5*s.*	900
Clapham.—77 and 78, Cottage-grove, u.t. 45 yrs., g.r. 4*l.*	555
28, Albert-sq., u.t. 45 yrs., g.r. 5*l.*, r. 55*l.*	490
South Lambeth.—24, Wilkinson-st., u.t. 62½ yrs., g.r. 6*l.* 10*s.*, r. 40*l.*	440
5, St. Stephen's-ter., u.t. 62½ yrs., g.r. 7*l.* 10*s.*, r. 40*l.*	440
316, South Lambeth-rd., u.t. 39 and 40½ yrs., g.r. nil, r. 52*l.* 10*s.*	525

By FOSTER & CRANFIELD.

City of London.—Fenchurch-st., f.g.r. 450*l.*, reversion in 41¾ yrs.	16,562

By F. J. BISLEY & SONS.

Rotherhithe.—110, Paradise-st., f., e.r. 30*l.*	440
Bermondsey.—170 and 172, Spa-rd., u.t. 19 yrs., g.r. 8*l.* 8*s.*, r. 65*l.*	460

By GILBERT & HOW.

Peckham.—Commercial-rd., i.g.r. 40*l.*, u.t. 60 yrs., g.r. 16*l.* 10*s.*	350

By Messrs. SPELMAN (at Norwich).

Norwich.—The Walk, a building site, area 342 ft., f.	1,000
Orford-place, two building sites, area 2,109 ft., f.	2,125

November 22.—By ALLAN BOOTH.

Hanwell.—Golden Manor-rd., Thurlow Lodge, and ½ acre, f. e.r. 85*l.*	955
Clapham.—34, Marjorie-grove, u.t. 93 yrs., g.r. 7*l.* 15*s.*, r. 36*l.*	380
Holloway.—Milton-grove, f.g.r. 12*l.*, reversion in 61 yrs.	280

By C. C. & T. MOORE.

Mile End.—398, Mile End-rd., f., r. 80*l.*	1,020
10 to 18 (even), 19, 21, and 23, Calverley-st., u.t. 44 yrs., g.r. 39*l.*	2,010
90 and 92, Turner's-rd., u.t. 63½ yrs., g.r. 10*l.*, r. 64*l.*	850
Fulham.—20, St. Mark's-rd., u.t. 43 yrs., g.r. 4*l.*, r. 36*l.*	345

By STIMSON & SONS.

Peckham.—Maxted-rd., &c., i.g.r.'s 80*l.*, u.t. 47 yrs., g.r. 18*l.*	1,000
Wandsworth-rd.—7 to 14, Knutsford-st., also i.g.r. 50*l.*, u.t. 8½ yrs., g.r. nil	650
Norwood.—Biggin Hill, f.g.r.'s 21*l.*, reversion in 80 yrs.	420
Camberwell.—Station Vale, i.g.r. 35*l.*, u.t. 54½ yrs., g.r. 10*l.*, with reversion	575
Bermondsey.—65, Page's-walk, u.t. 11 yrs., g.r. 40*l.*	220
St. Pancras.—18, 20, and 38, Werrington-st., u.t. 48½ yrs., g.r. 24*l.*, r. 112*l.*	820
15, Penryn-st., u.t. 49½ yrs., g.r. 5*l.*, r. 36*l.*	375
Rotherhithe.—1 and 5, Neptune-st., f.	840
Lewisham.—19, Mount Pleasant-rd., u.t. 87½ yrs., g.r. 8*l.* 10*s.*	260
Norwood.—38, Palace-sq., u.t. 83 yrs., g.r. 7*l.* 7*s.*, r. 48*l.*	250

By S. WALKER & SON.

Clapham.—42 to 45, Park-cres., u.t. 49 yrs., g.r. 13*l.* 19*s.*, r. 108	935
Brompton.—9, Kempsford-gdns., u.t. 66 yrs., g.r. 6*l.*, r. 45*l.*	485

By NEWBON, EDWARDS & SHEPHARD.

Brixton.—82, 90, 94, 96 and 100, Dalyell-rd., u.t. 64 yrs., g.r. 31*l.* 10*s.*	£1,660
Hoxton.—23, Bookham-st., u.t. 34 yrs., g.r. 5*l.*, r. 33*l.*	325
Caledonian-rd.—33, Bingfield-st., u.t. 40 yrs. g.r. 4*l.* 10*s.*, r. 42*l.*	445
Holloway.—34, Parkhurst-rd., u.t. 45 yrs., g.r. 8*l.*, e.r. 45*l.*	410
310, Liverpool-rd., u.t. 35 yrs., g.r. 3*l.*, r. 55*l.*	555
33, Eden-gr., f., e.r. 50*l.*	685
42 and 44, George's-rd., f., e.r. 70*l.*	760
Kentish Town.—33, Woodsome-rd., u.t. 61½ yrs., g.r. 7*l.*, e.r. 52*l.*	505
Dalston.—7, Livermere-rd., u.t. 39 yrs., g.r. 4*l.*, r. 34*l.*	360
43 to 55 (odd), Brougham-rd., u.t. 45 yrs., g.r. 26*l.* 5*s.*, r. 197*l.* 8*s.*	2,295

By WORSFOLD & HAYWARD (at Dover).

Dover, Kent.—24 and 27, Marine-parade, u.t. 24½ yrs., g.r. 3*l.* 13*s.* 6*d.*, r. 195*l.*	1,725
4 and 5, Pioneer-ter., u.t. 93 yrs., g.r. 4*l.*	465

By PHILIP DAVIES (at Knighton).

Hopton Castle, Salop.—Hagley Estate, 281 a. 0 r. 4 p., f. (including timber)	5,350

By BEALE & CAPPS (at Notting Hill).

Notting Hill.—132, Portland-rd., u.t. 51⅛ yrs., g.r. 10*l.*	225
407 and 409, Portobello-rd., u.t. 80 yrs., g.r. 20*l.*	460
6 and 7, Queen's-pl., u.t. 40½ yrs., g.r. 4*l.*	350
119, Lancaster-rd., u.t. 46 yrs., g.r. 5*l.*, e.r. 50*l.*	485

By BATCHELAR & SON (at Croydon).

Croydon.—Elmwood-rd., Elmwood Lodge, f., r. 70*l.*	1,400

November 23.—By C. CASSIN & CO.

Catford.—161 to 177 (odd), Brownhill-rd., f., r. 336*l.*	5,000
Ladywell.—120 and 148, Ladywell-rd.; 4 and 10, Arthurdon-st.; 5 and 7, Francemary-st., u.t. 91 yrs., g.r. 35*l.*, r. 180*l.*	1,785

By DOLMAN & PEARCE.

Kentish Town.—50, Patshull-rd., u.t. 60½ yrs., g.r. 7*l.* 7*s.*, r. 50*l.*	615
11, Burghley-rd., u.t. 62½ yrs., g.r. 10*l.*, r. 55*l.*	600
31 to 39 (odd) and 43, Leverton-st., u.t. 48 yrs., g.r. 45*l.*, r. 236*l.*	2,340
Leverton-st., i.g.r.'s 60*l.*, u.t. 48 yrs., g.r. 10*l.*	860
Falkland-rd., i.g.r.'s 15*l.*, u.t. 48 yrs., g.r. 2*l.*	270
Camden Town.—13, South-villas, u.t. 62 yrs., g.r. 11*l.*, r. 48*l.*	600
Haverstock Hill.—15, Maitland Park-villas, u.t. 52 yrs., g.r., &c., 11*l.*, e.r. 50*l.*	500
48, Parkhill-rd., u.t. 50 yrs., g.r. 12*l.*, r. 70*l.*	695
Hampstead.—42 and 45, Upper Park-rd., u.t. 50 yrs., g.r. 25*l.*, r. 115*l.*	1,085

By A. J. SHEFFIELD.

Commercial-rd. East.—No. 255, u.t. 13½ yrs., g.r. 50*l.*, e.r. 150*l.*	175
14A, 14 to 20 (even), Philpot-st., u.t. 12 yrs., g.r. 130*l.*	700
Poplar.—46 and 48, Bath-st., u.t. 43 yrs., g.r. 8*l.*	485
19, Willis-st., u.t. 44½ yrs., g.r. 3*l.*	205
42, Wade-st., f., r. 26*l.*	280
Old Ford.—4 and 5, Tamar-st., f.	530

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£	s.	d.			
Hard Stocks	1	16	0	per 1,000	alongside, in river.	
Rough Stocks and Grizzles	1	12	0	,,	,,	,,
Smooth Bright Facing Stocks..	2	18	0	,,	,,	,,
Shippers	2	6	0	,,	,,	,,
Flettons.....	1	10	6	,,	at railway depôt.	
Red Wire Cuts ..	1	15	6	,,	,,	,,
Best Fareham Red	3	11	6	,,	,,	,,
Best Red pressed Ruabon Facing.	5	5	0	,,	,,	,,
Best Blue Pressed Staffordshire ..	4	7	0	,,	,,	,,
Do., Bullnose	4	12	0	,,	,,	,,
Best Stourbridge Fire Bricks	4	4	6	,,	,,	,,
GLAZED BRICKS.						
Best White and Ivory Glazed Stretchers.....	13	0	0	,,	,,	,,
Headers	12	0	0	,,	,,	,,
Quoins, Bullnose, and Flats	17	0	0	,,	,,	,,
Double Stretchers	19	0	0	,,	,,	,,
Double Headers..	16	0	0	,,	,,	,,
One Side and two Ends	19	0	0	,,	,,	,,
Two Sides and one End	20	0	0	,,	,,	,,
Splays, Chamfered, Squints	20	0	0	,,	,,	,,
Best Dipped Salt Glazed Stretchers and Headers ..	12	0	0	,,	,,	,,
Quoins, Bullnose, and Flats	14	0	0	,,	,,	,,
Double Stretchers	15	0	0	,,	,,	,,
Double Headers..	14	0	0	,,	,,	,,
One Side and two Ends	15	0	0	,,	,,	,,
Two Sides and one End	15	0	0	,,	,,	,,
Splays, Chamfered, Squints	14	0	0	,,	,,	,,
Seconds Quality White and Dipped Salt Glazed	2	0	0	,,	less than best.	

[See also next page.

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered
*Public Offices	Hindley U.D.C.	50*l.*, 25*l.* and 10*l.*	Jan. 18

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Forms of Tender, &c., Supplied by	Tenders to be delivered
*Sewerage Works	Bromley U.D.C	Surveyor, Council Offices, Bromley, Kent	Dec. 4
Additions to Schools, Church-road, Gorleston	Great Yarmouth School Board	Bottle & Olley, Architects, Queen-street, Great Yarmouth	do.
Building Work, Kerr's Buildings	Belfast Guardians	Young & Mackenzie, Civil Engineers, Donegall-square, Belfast	do.
Alterations to Hospital, Grape-lane	Whitby Hospital Committee	E. H. Smales, Architect, 5, Flowergate, Whitby	do.
Alterations to "Stakesby," Whitby	J. H. Harrowing	W. C. Hall, Architect, Park-row, Leeds	do.
Sewerage Works	Leicester Corporation	E. G. Mawbey, Civil Engineer, Town Hall	do.
Sewer, Church-road	Shoeburyness U.D.C.	H. Harris, Surveyor, Southend	do.
Road Works	Newburn U.D.C.	T. Gregory, Engineer, Council Offices, Newburn	do.
Two Cottages, Claydon, near Fenny Compton	Great Western Railway Company	G. K. Mills, Paddington Station, W.	do.
Waterworks Extension, Waterton	Aberdeen Town Council	Jenkins & Marr, Civil Engineers, 16, Bridge-street, Aberdeen	do.
Water Supply, Lavernock	Llandaff R.D.C.	Surveyor, 35, St. Mary-street, Cardiff	do.
Disinfecting Chamber	Kilkenny U.D.C.	W. K. Cleere, Council Offices, Kilkenny	do.
*Supply of Stores	Great Northern Railway	Stores Superintendent, Doncaster	do.
*Window Cleaning	East Ham School Board	Clerk, School Board Offices, East Ham, E.	Dec. 5
*Making-up Roads	Fulham Borough Council	Surveyor, Town Hall, Walham Green, S.W.	do.
Sewage Purification Works	Ottery St. Mary (Devon) U.D.C.	E. G. Warren, Architect, Commercial Chambers, Exeter	do.
Additions to Workhouse Infirmary	Alcester Guardians	W. H. Ward, Architect, Paradise-street, Birmingham	do.
Bungalow, Hayle, Cornwall	Mrs. J. T. Mudge	S. Hill, Architect, Redruth	do.
Nine Houses, Eden-street, Saltburn-by-Sea	North-Eastern Railway Company	W. Bell, Architect, York	do.
Bridge, Bronant	Cardiganshire County Council	R. Lloyd, County Surveyor, Tregaron	do.
Road Diversion, Alltwen	Glamorgan County Council	T. M. Franklen, County Offices, Cardiff	do.
Paving Works, Victoria-place	Leith (N.B.) Town Council	Burgh Surveyor, Town Hall	do.
Additions to Electricity Works, Bolton-road	Bradford Corporation	E. A. Chattock, Civil Engineer, Town Hall	Dec. 6
Drainage Works, Stoke-road	Guildford School Board	R. L. Lunn, Surveyor, 36, High-street, Guildford	do.
Sewerage Works, Woodsmoor-lane	Hazelgrove U.D.C.	R. Sykes, Civil Engineer, 9, High-street, Cheadle	do.
Additions to Workhouse, Lyminge, Kent	Elham Guardians	R. Lonergan, Saltwood, Hythe	do.
Street Works, Arundel-road	Southend Corporation	A. Fidler, Civil Engineer, Town Hall	do.
Foundations, &c., Hayes, Middlesex	.....	Secretary, Electric Company, Woodfield-road, Harrow-road, W.	Dec. 7
School, South William-street, Workington	Rev. Mr. Hutchinson	J. Howes, Architect, 23, Curwen-street, Workington	do.
Street Works	Sandal Magna U.D.C.	F. Massie, Civil Engineer, Tetley House, Wakefield	Dec. 8
Drainage Works, Dalry, N.B.	.....	J. Barr, Civil Engineer, 221, West George-street, Glasgow	do.
Bank Premises, Cleator Moor	Bank of Whitehaven, Limited	A. Huddart, Architect, 22, Lowther-street, Whitehaven	do.
Additions to Hospital, Lytham, Lancs	.....	Haywood & Harrison, Architects, Lytham	do.
Alterations to Police Station, Merthyr	Glamorgan County Council	T. M. Franklen, Council Offices, Cardiff	do.
Additions to Police Station, Caerphilly	do.	do.	do.
Police Station, Cilfynydd	do.	do.	do.
Road Works, &c., Cross Hills, Yorks	.....	F. W. Petty, Architect, Woodridge, Cross Hills	Dec. 10
Villa, Maidstone-road, Chatham	.....	E. J. Hammond, Civil Engineer, High-street, New Brompton	do.
Public Conveniences, Grand Parade	Eastbourne Town Council	R. M. Gloyne, Civil Engineer, Town Hall	do.
House, Boughton	Nottingham Corporation	W. B. Starr, Architect, 12, St. Peterzgate, Nottingham	do.
Electric Light Station, Hylton-road	Sunderland Corporation	F. M. Bowey, Town Hall	do.
Lodge at Sanatorium, Hucknall-lane	Basford (Notts) R.D.C.	W. V. Betts, Architect, Radford-road, Old Basford	do.
Schools, Rofft-y-Crown, Denbigh	.....	J. Hughes, Architect, Denbigh	do.
Goods Shed, Broomielaw Quay, Glasgow	Clyde Navigation Trustees	W. M. Alston, Engineer, 16, Robertson-street, Glasgow	do.
Pumping Station, Loxford-lane	Ilford U.D.C.	J. Taylor, Sons, & Santo Crimp, C.E., 27, Great George-st., S.W.	do.
Granite Setts (3,000 tons)	Royston U.D.C.	T. Bleasdale, Surveyor, Town Hall, Royston	do.
Asylum, Kingseat	Aberdeen Lunacy Board	A. M. Mackenzie, Architect, 343, Union-street, Aberdeen	do.
*Pulling Down Building	Barking Town U.D.C.	Surveyor, Public Offices, Barking, Essex	Dec. 11
Road Works, Allison-street	Amble U.D.C.	W. Gibson, Surveyor, 31, Queen-street, Amble	do.
*Road Making, &c., Works	Willesden District Council	Engineer, Public Offices, Dyne-road, Kilburn, N.W.	do.
*Buildings	Greenwich Guardians	T. Dinnidy, Architect, 12, Crooms Hill, Greenwich	Dec. 13
*Making-up Roads	Hackney Borough Council	Borough Engineer, Town Hall, Hackney, N.E.	do.
Sewerage Works and Five New Streets	Horwich (Lancs) U.D.C.	Surveyor, Public Hall, Horwich	Dec. 15
*Taking Down and Rebuilding Bridge	Headington R.D.C.	See Advertisement	Dec. 18
*Wiring, &c	Winwick County Asylum	Clerk, County Offices, Preston	Dec. 29
*Wiring and other Works	Metropolitan Asylums Board	Offices, Embankment, E.C.	Jan. 2
*Grayswood Church and Vicarage	.....	Oliver & Dodgshun, Architects, Carlisle	No date
*Barrack Blocks at Colchester	War Department	Royal Engineer Office, Colchester	do.
Stables, Engine House, &c., Bradford-road	East Ardsley (Yorks) U.D.C.	R. Brooke, Surveyor, Blackgates, Tingley	do.
Offices, &c., Yorkshire-street	Burnley Corporation	G. H. Pickles, Civil Engineer, Town Hall, Burnley	do.
Street and Sewerage Works, The Middles, Durham	.....	J. W. Rounthwaite, Architect, 13, Mosley-street, Newcastle	do.
Additions to Middleton Hall, Gorebridge, N.B.	Mr. H. E. Moss	J. MacIntyre Henry, Architect, 7, South Charlotte-st., Edinburgh	do.
Fifty-two Houses, The Middles, near West Stanley	.....	J. W. Rounthwaite, Architect, 13, Mosley-street, Newcastle	do.
Store Premises	York Equitable Industrial Soc. Ltd	Athron & Beck, Architects, Dolphin-chambers, Doncaster	do.
Four Houses, Balmoral-terrace, South Bank	do.	do.	do.
Schools	Kinson (Dorset) School Board	W. Andrew, Architect, Alton Office, Parkstone	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary	Application to be in
*Borough Surveyor	Dartmouth Town Council	.....	Dec. 5
*Surveyor and Assistant Clerk	Penge U.D.C.	250*l.*, and 200*l.* per annum	Dec. 7
*Engineer and Engineering Assistant	Sheffield Corporation	200*l.*, and 180*l.* per annum	Dec. 8
*Quantity Surveyor's Assistant	London County Council	4*l.* 4*s.* per week	Dec. 10

Those marked with an asterisk (*) are advertised in this Number. *Competitions, p.* iv. *Contracts, pp.* iv, vi. viii. x. *&* xix. *Public Appointments, pp.* xvii. *&* xix.

PRICES CURRENT *(Continued).*

BRICKS, &c.

	s.	d.	
Thames and Pit Sand	8	0	per yard, delivered.
Thames Ballast	6	9	,, ,,
Best Portland Cement	38	0	per ton ,,
Best Ground Blue Lias Lime	24	6	,, ,,

NOTE.—The cement and lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime ..... 12s. 6d. per yard, delivered.
Stourbridge Fire-clay in sacks, 32s. 6d. per ton at rly. dpt.

PRICES CURRENT *(Continued).*

STONE.

	s.	d.	
Ancaster in blocks	2	0	per ft. cube, deld. rly. depôt
Bath ,,	1	7	,, ,,
Farleigh Down Bath	1	8	,, ,,
Beer in blocks	1	6½	,, ,,
Grinshill ,,	1	10	,, ,,
Brown Portland in blocks	0	9	,, ,,
Darley Dale ,,	2	1½	,, ,,
Red Corsehill ,,	2	3	,, ,,
Red Mansfield ,,	2	4½	,, ,,

PRICES CURRENT *(Continued).*

STONE.

	s.	d.		
Hard York in blocks	2	10	per ft. cube, deld. rly. depôt.	
Hard York 6 in. sawn both sides landings, to sizes (under 40 ft. sup.)	2	8	per ft. super. at rly. depôt.	
,, ,, 6 in. Rubbed Ditto	3	0	,,	,,
,, ,, 3 in. sawn both sides slabs (random sizes)	1	3	,,	,,
,, ,, 3 in. self-faced Ditto	0	9½	,,	,,

PRICES CURRENT (*Continued*).

SLATES.

	£ s. d.	
in. in.		
20×10 best blue Bangor..	11 5 0	per 1000 of 1200 at rly. dep.
,, best seconds ,,	10 15 0	,, ,,
16× 8 best ,,	6 2 6	,, ,,
20×10 best blue Portmadoc	10 18 0	,, ,,
16× 8 best blue Portmadoc	6 0 0	,, ,,
20×10 best Eureka unfading green.....	11 2 6	,, ,,
16× 8 ,, ,,	6 15 0	,, ,,
20×10 Permanent green	10 0 0	,, ,,
16× 8 ,, ,,	5 12 6	,, ,,

TILES.

	s. d.	
Best plain red roofing tiles..	41 6	per 1,000 at rly. depôt
Hip and valley tiles.....	3 7	per doz. ,, ,,
Best Broseley tiles	48 6	per 1,000 ,, ,,
Hip and valley tiles.....	4 0	per doz. ,, ,,
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000 ,, ,,
Do. ornamental Do.	60 0	,, ,, ,,
Hip tiles.....	4 0	per doz. ,, ,,
Valley tiles.....	3 9	,, ,, ,,
Best Red or Mottled Staffordshire Do. (Peakes) .	50 9	per 1,000 ,, ,,
Hip tiles	4 1	per doz. ,, ,,
Valley tiles.....	3 8	,, ,, ,,

WOOD.

BUILDING WOOD.—YELLOW.

	At per standard. £ s. d.	£ s. d.
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.	16 10 0	18 0 0
Deals: best 3 by 9	14 10 0	15 10 0
Battens: best 2½ in. by 7 in. and 8 in. and 3 in. by 7 in. and 8 in.....	12 10 0	13 10 0
Battens: best 2½ by 6 and 3 by 6 ..	0 10 0	less than 7 in. and 8 in.
Deals: seconds.....	1 0 0	less than best
Battens: seconds.....	0 10 0 ,, ,, ,,	
	At per load of 50 ft.	
Fir timber: Best middling Dantzig or Memel (average specification)	4 10 0	5 0 0
Seconds	4 5 0	4 10 0
Small timber (8 in. to 10 in.)	3 12 6	3 15 0
Swedish balks.....	3 15 0	3 0 0
Pitch pine timber (35 ft. average)..	4 0 0	4 10 0

JOINERS' WOOD.	At per standard.	
White Sea: First yellow deals, 3 in. by 11 in.....	27 10 0	28 10 0
3 in. by 9 in.	24 0 0	25 0 0
Battens, 2½ in. and 3 in. by 7 in.	20 0 0	21 0 0
Second yellow deals, 3 in. by 11 in.	22 10 0	24 0 0
,, ,, 3 in. by 9 in.	20 0 0	21 0 0
Battens, 2½ in. and 3 in. by 7 in.	16 10 0	18 0 0
Third yellow deals, 3 in. by 11 in. and 9 in.	16 10 0	18 0 0
Battens, 2½ in. and 3 in. by 7 in.	13 10 0	14 10 0
Petersburg: first yellow deals, 3 in. by 11 in.	25 0 0	26 0 0
Do. 3 in. by 9 in.	22 0 0	23 0 0
Battens.....	16 10 0	17 10 0
Second yellow deals, 3 in. by 11 in.....	28 10 0	30 0 0
Do. 3 in. by 9 in.	17 0 0	18 0 0
Battens.....	14 0 0	14 10 0
Third yellow deals, 3 in. by 11 in.....	15 0 0	16 10 0
Do. 3 in. by 9 in.	14 0 0	14 10 0
Battens.....	12 10 0	13 10 0
White Sea and Petersburg:—		
First white deals, 3 in. by 11 in..	15 10 0	16 10 0
,, ,, ,, 3 in. by 9 in. ..	14 0 0	15 0 0
Battens.....	12 10 0	13 10 0
Second white deals 3 in. by 11 in.	14 0 0	15 0 0
,, ,, ,, 3 in. by 9 in.	13 0 0	14 0 0
,, ,, battens	11 0 0	12 0 0
Pitch pine: deals.....	16 0 0	18 0 0
Under 2 in. thick extra	0 10 0	1 0 0
Yellow Pine—		
First, regular sizes	30 0 0	33 0 0
Broads (12 in. and up)	2 0 0	more.
Oddments	22 0 0	24 0 0
Seconds, regular sizes	24 10 0	26 10 0
Yellow Pine Oddments	20 0 0	22 0 0
Kauri Pine—		
Planks, per ft. cube	0 3 6	0 4 6
Dantzig and Stettin Oak Logs—		
Large, per ft. cube	0 2 6	0 2 8
Small ,, ,, ...	0 2 4	0 2 7
Wainscot Oak Logs, per ft. cube ..	0 3 0	0 3 6
Dry Wainscot Oak, per ft. sup. as inch	0 0 8	0 0 9
½ in. do. do.	0 0 7	. . .
Dry Mahogany—		
Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0
Dry Walnut, American, per ft. sup. as inch.....	0 0 10	0 1 0
Teak, per load	16 0 0	20 0 0
American Whitewood Planks—		
Per ft. cube.....	0 0 3	0 0 0

JOISTS, GIRDERS, &c.

	In London, or delivered to Railway Vans, per ton. £ s. d.	£ s. d.
Rolled Steel Joists, ordinary sections	9 2 6	10 2 6
Compound Girders ,, ,,	12 5 0	13 10 0
Angles, Tees and Channels, ordinary sections	12 10 0	14 10 0
Flitch Plates	11 7 6	12 0 0
Cast Iron Columns and Stanchions, including ordinary patterns	8 15 0	10 10 0

PRICES CURRENT (*Continued*).

METALS.

	Per ton, in London. £ s. d.	£ s. d.
IRON.—		
Common Bars.....	9 15 0	. . .
Staffordshire Crown Bars, good merchant quality	10 5 0	10 10 0
Staffordshire "Marked Bars" ..	12 0 0	. . .
Mild Steel Bars.....	10 10 0	11 0 0
Hoop Iron, basis price.....	10 10 0	11 0 0
,, ,, galvanised	16 10 0	. . .
(* And upwards, according to size and gauge.)		
Sheet Iron, Black.—		
Ordinary sizes to 20 g.	11 0 0	. . .
,, ,, to 24 g.....	12 0 0	. . .
,, ,, to 26 g.....	13 10 0	. . .
Sheet Iron, Galvanised, flat, ordinary quality.—		
Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.....	13 5 0	. . .
,, ,, 22 g. and 24 g.	14 5 0	. . .
,, ,, 26 g.....	16 0 0	. . .
Sheet Iron, galvanised, flat, best quality.—		
Ordinary sizes to 20 g.	17 10 0	. . .
,, ,, 22 g. and 24 g.	18 0 0	. . .
,, ,, 26 g.	19 10 0	. . .
Galvanised Corrugated Sheets.—		
Ordinary sizes, 6 ft. to 8 ft. 20 g.	13 10 0	. . .
,, ,, 22 g. and 24 g.	14 0 0	. . .
Cut nails, 3 in. to 6 in.....	11 10 0	. . .
(Under 3 in. usual trade extras.)		
LEAD—Sheet, English, 3 lbs. & up.	19 17 6	. . .
Pipe in coils -----------	20 7 6	. . .
Soil Pipe..	23 7 6	. . .
ZINC—Sheet—		
Vieille Montagne ------ ton	27 0 0	. . .
Silesian.....	26 10 0	. . .
COPPER—		
Strong Sheet..... per lb.	0 1 1	. . .
Thin ..... ,,	0 1 3	. . .
Copper nails ..... ,,	0 1 3	. . .
BRASS—		
Strong Sheet..... ,,	0 0 11	. . .
Thin ,, ... ,,	0 1 1	. . .
TIN—English Ingots ---- ,,	0 1 5	. . .
SOLDER—Plumbers' ---- ,,	0 0 7½	. . .
Tinmen's ---------- ,,	0 0 9½	. . .
Blowpipe ---------- ,,	0 0 11	. . .

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	2½d. per ft. delivered.
,, fourths	2¾d. ,, ,,
21 oz. thirds	3½d. ,, ,,
,, ,, fourths.....	3d. ,, ,,
26 oz. thirds	4½d. ,, ,,
,, ,, fourths	4d. ,, ,,
32 oz. thirds	5½d. ,, ,,
,, ,, fourths	5d. ,, ,,
Fluted sheet, 15 oz.	3½d. ,, ,,
,, ,, 21 ,, ...	4½d. ,, ,,
½ Hartley's Rolled Plate.....	3d. ,, ,,
¼ ,, ,, ,, -----	3½d. ,, ,,
⅛ ,, ,, ,, -----	4d. ,, ,,

OILS, &c.

	£ s. d.	
Raw Linseed Oil in pipes..... per gallon	0 2 11	
,, ,, ,, in barrels ..... ,,	0 3 0	
,, ,, ,, in drums ..... ,,	0 3 2	
Boiled ,, ,, in pipes..... ,,	0 3 2	
,, ,, ,, in barrels ..... ,,	0 3 3	
,, ,, ,, in drums ..... ,,	0 3 5	
Turpentine, in barrels ..... ,,	0 2 9	
,, in drums..... ,,	0 2 11	
Genuine Ground English White Lead ...per ton	28 0 0	
Red Lead, Dry..... ,,	25 0 0	
Best Linseed Oil Putty.....per cwt.	0 9 6	
Stockholm Tar ..... per barrel	1 10 0	

VARNISHES, &c.

	per gallon. £ s. d
Fine Elastic Copal Varnish for outside work ..	0 16 6
Best Elastic Copal Varnish for outside work ..	1 0 0
Best Elastic Carriage Varnish for outside work	0 16 6
Best Hard Oak Varnish for inside work	0 10 6
Best Extra Hard Church Oak Varnish for inside work	0 10 6
Fine Hard Copal Varnish for inside work	0 16 0
Best Hard Copal Varnish for inside work	1 0 0
Best Hard Carriage Varnish for inside work....	0 16 0
Extra Pale Paper Varnish	0 12 0
Best Japan Gold Size	0 10 0
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 9 0
Berlin Black	0 15 0
Knotting	0 10 0
Best French and Brush Polish	0 10 0

TO CORRESPONDENTS.

N. H. D. (Below our limit.)

NOTE.—The responsibility of signed articles, letters and papers read at meetings, rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

We are compelled to decline pointing out books and giving addresses.

Any commission to a contributor to write an article is given subject to the approval of the article, when written, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

TENDERS.

(Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 10 a.m. on Thursdays.* N.B.—We cannot publish tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of tenders accepted unless the amount of the tender is given, nor any list in which the lowest tender is under £100, unless in some exceptional cases and for special reasons.)

* Denotes *accepted.* † Denotes *provisionally accepted.*

BRIGHOUSE.—For the erection of a Congregational church, Waring Green. Messrs. Sharp & Waller, architects, 32, Bradford-road, Brighouse:—

Masonry.—Fearnley Bros., Clifton..	£1,123 17 0
Joinery.—Fielding & Bottomley, Halifax	737 16 8
Plumbing.—A. L. Waddington, Brighouse	227 5 6
Plastering.—Castle & Hynes, Brighouse.....	154 10 0
Slating.—Jas. Smithies, Brighouse..	162 10 0
Painting.—John W. Turner, Brighouse.....	40 18 0

BROMSGROVE.—For the erection of isolation hospital at Hill Top, Bromsgrove, for the Bromsgrove, Droitwitch, and Redditch Joint Boards. Mr. Henry T. Hare London, and Herbert R. Lloyd, Birmingham, joint architects:—

Barnsley & Son..	£12,388 0	J. Dallow	£11,195 0
C. Bryant	12,245 0	Dorse & Co.....	11,125 0
T. Rowbotham	12,120 0	W. Hopkins.....	10,800 0
Hurley & Son ..	11,963 0	W. & J. Webb	10,550 0
Sapcote & Son..	11,837 0	W. Bishop	10,445 0
Huino & Son ..	11,600 0	J. Tilt	10,400 0
D. Panter	11,506 12	Harvey Gibbs..	10,350 0
Guest & Son....	11,500 0	J. & A. Brazier, Bromsgrove*	10,080 0
Moffat & Son ..	11,370 0	Gowing & Ingram	9,993 0
T. Broad	11 325 0		
Smith & Pitt ..	11,277 0		

CASTLEFORD.—For the formation and laying out of extension to burial ground, Cemetery-lane, Castleford, for the Castleford and Glass Houghton Burial Board. Contract No. 1—Erection of boundary walls. Contract No. 2—Drainage and asphalting. Messrs. Garside & Pennington, architects and surveyors, Pontefract and Castleford:—

Contract No 1.

J. Craven & Son, Castleford*† £314 10

Contract No 2.

J. L. Rodgers, Castleford* 686 0

CASTLEFORD.—For additions to business premises, Carlton-street, for Mr. Charles Farber. Messrs. Garside & Pennington, architects, Pontefract:—

Walker Bros., Castleford* £150

CASTLEFORD.—For erecting play sheds at the Board schools, for the Glass Houghton School Board, Castleford. Messrs. Garside & Pennington, architects:—

Wilson & Sons, Castleford* £105

CHADWELL HEATH.—For the erection of villa residence in Whalebone-grove, for Mr. A. Tatham. Mr. J. M. H. Gladwell, architect, 34, Lawrence-road, Bow:—

A. Webb	£1,595	J. R. Holliday.....	£1,275
G. R. Reid	1,500	Finegan & Co.*	1,148
G. W. Death	1,350		

CRADLEY HEATH.—For the supply of broken Rowley granite (400 tons) for the Quarry Bank Urban District Council. Mr. J. T. Abbiss, surveyor, Quarry Bank:—

Edwin Richards	8 0 per ton.
Rowley Regis Granite Quarries, Ltd.	7 9 ,,
J. W. Knowles,* Rowley, Staffs.	6 11 ,,

DEVONPORT.—For the erection of electricity works, buildings, &c., East Stonehouse, exclusive of chimney and flues. Mr. Charles Furniss, Borough Electrical Engineer, Devonport. Quantities by Mr. H. Gray Robins, 55-56, Chancery-lane, London:—

May	£7,969	Wakeham Bros.	£5,906
Hortop	7,291	Blake	5,831
Skinner	6,821	Lapthorn	5,709
Hatcham & Co.	6,710	A. N. Coles, Plymouth*	5,433
R. H. B. Heal.....	6,140		

DONCASTER.—For the execution of private street works, Church-street, &c., Butcher-street, and Cross Butcher-street, Thurnscoe, for the Rural District Council. Mr. J. R. Dodds, Civil Engineer, 19, Baxter-gate, Doncaster:—

W. Johnson ..	£2,633 0 0	W. H. Cliffe..	£2,021 17 10
R. T. Hodgson	2,307 9 6	J. Holmes	1,823 0 0
Jones Bros. ..	2,214 19 2	Yardley, Dransfield, and Taylor‡	904 6 7
W. Chapman .	2,207 7 9		
F. Eyre	2,194 15 10		
B. Roberts, Retford* ..	2,040 16 10		

‡ Church-street only.

(Engineer's estimate, £2,283 5s. 8d.)

DUNDALK.—For additions, &c., to old Grammar School buildings and conversion into free library. Mr. Wm. Beck, architect, Dundalk:—

McAdorey ..	£1,198 0 0	McGuinness, Dundalk* ..	£1,041 18 6
Wynne	1,193 0 0		
Parks	1,171 16 10		

ILFORD.—For the erection of stables at St. Mary's Bakery, Ilford, for Mr. Alfred Brown. Messrs. Beet & Gray, architects, Albany Chambers, 41, Haymarket, S.W. Quantities by the architects:—

Cole & Mundy	£187 10	S. E. Moss	£177 0
John Beene	183 0	F. Wilmott	158 0

[*See also next page.*

ILFORD (Essex).—For erection of Methodist Free Church, Ilford-lane, for the trustees. Mr. F. W. Dixon, architect, Trevelyan Buildings, Manchester. Quantities prepared by Mr. A. Goodchild, 81, Finsbury-pavement, London, E.C.:—

F. & E. Davey	£6,995	F. Willmott	£5,225
G. H. Hosking	5,827	Battley, Sons, & Holness	5,167
Castle & Son	5,800	J. W. Jerram	5,123
G. Sharpe	5,756	F. J. Coxhead	5,027
S. J. Scott	5,695	W. J. Maddison, Clarkson-street, Canning Town, E.†	4,926
A. E. Symes	5,550		
J. Jolliffe	5,395		
Shelbourne & Co.	5,249		

LONDON.—For structural repairs to the stable block at Deerfield, Beulah Hill, Norwood, for Mr. J. Jonas. Mr. Percy L. Marks, architect:—

J. & C. Bowyer	£140 0	A. V. Paddison*	£136 10

Including as a provision for ventilation:—
Boyle & Son* £13 5 6

For waterproofing walls and for complete decorative repairs:—
Szerelmey & Co.* £25

Sundry extra works, including to out buildings, &c.:—
A. V. Paddison* ..... £17 8 11 (net).

For structural and decorative repairs and alterations to house and messuage (including laying new drainage system):—

A. V. Paddison	£1,088 12	J. & C. Bowyer	£786 0
F. & H. F. Higgs	857 0		

For modified requirements (but including electric-light installation):—
Dance, Bryant, & Co.* £536

LONDON.—For the erection of a warehouse in High-road, Balham. Mr. M. St. Pierre Harris, architect, 8, Ironmonger-lane, E.C. Quantities by Messrs. Stanger & Sons, 21, Finsbury-pavement, E.C.:—

J. Carmichael	£1,164	Somerford & Son	£973
F. & H. F. Higgs	1,110	Garrett & Son	935
Gregory & Co.	1,063		

LONDON.—For alterations and repairs to factory and premises, Union-street, Borough. Mr. M. St. Pierre Harris, architect, 8, Ironmonger-lane, E.C.:—

Gregory & Co.	£469	W. E. Hill	£381
Garrett & Sons	401	G. Newton	327

NEWTON ABBOT.—For a new road, with sewers, boundary walls, &c., at Highweek, for the Feoffees of Highweek. Messrs. J. W. Rowell & Son, architects, Newton Abbot. Quantities by Mr. Vincent Cattermole Brown, of Paignton:—

W. Gibson	£385	F. A. Stacey	£367
L. Bearne	727	Geo. Hicks, Newton Abbot	550
W. A. Goss	698		
R. F. Yeo	635		

NEWTON ABBOT.—For new girls' school at Highweek, for the Highweek School Board. Messrs. J. W. Rowell & Son, architects, Newton Abbot. Quantities by Mr. Vincent Cattermole Brown, of Paignton:—

W. Gibson	£2,846 0	H. Drew	£2,180 0
F. J. Stokes	2,524 0	R. F. Yeo	2,160 0
W. A. Goss	2,398 0	F. Stacey, Newton Abbot*	2,051 19
L. Bearne	2,315 0		
Geo. Hicks	2,300 0		

ORPINGTON (Kent).—For rebuilding premises, consisting of a shop and dwelling-house, at the corner of Chapel-square. Mr. M. St. Pierre Harris, architect, Orpington, and 7 and 8, Ironmonger-lane, E.C.:—
E. R. Thorne (no competition)* £756

ORPINGTON (Kent).—For the erection of a pair of houses. Mr. M. St. Pierre Harris, architect, Orpington, and 8, Ironmonger-lane, E.C.:—

Somerford & Son	£448	W. Owen (too late)	£850
T. W. Graty	873	T. Knight	679

RADLETT (Herts).—For proposed residence. Messrs. S. Doddimeade Edmunds, architect, St. Albans and London:—

J. Verdon	£1,900 0 0	Boff Bros.	£1,230 0 0
C. H. Taylor	1,372 14 3	G. Wiggs	1,140 0 0
W. King	1,310 0 0		

RADLETT (Herts).—For residence, corner of Aldenham-avenue and the Crosspath. Mr. S. Doddimeade Edmunds, architect, St. Albans and London:—

J. A. Chote	£1,000	Goodchild & Sons, St. Albans*	£695
Stevens & Sons	780		
Boff Bros.	758		

SIDCUP (Kent).—For the erection of twelve villas at Northcote-road. Mr. M. St. Pierre Harris, architect, 8, Ironmonger-lane, E.C., and Orpington:—
Stebbings & Pannett (no competition)* £3,114

SLIGO.—For the erection of chapel in the Asylum grounds for the Committee of Management of Sligo District Lunatic Asylum. Messrs. Sir Thomas Deane & Son, architects, 15, Ely-place, Dublin:—

J. & P. Good	£3,200	John Clarence	£4,600
Michael Gallagher	3,200	D. McLynn, Sligo*	4,275

WESTON-SUPER-MARE.—For the completion of roads on the Manor estate. Mr. F. Hans Price, surveyor, Manor Estate Office, Weston-super-Mare:—
William Dyer, Weston-super-Mare £687

WREXHAM.—For the erection of a workshop, Madeira-hill National School, Wrexham. Messrs. Davies & Moss, architects, 11, Regent-street, Wrexham. Quantities by architects:—

Davies Bros.	£217	W. Hughes	£171
J. Hughes	215	R. Jones, Wrexham	168
W. E. Samuel	205		

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